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IP Tunnel MIB

Status of this Memo

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1. 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 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-IPv4 networks (including IPv6 networks). Management of such tunnels may be supported by other MIBs.

Table of Contents

2. Introduction

Over the past several years, there have been a number of "tunneling" protocols specified by the IETF (see [28] 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 networks, including GRE [16,17], IP-in-IP [18], Minimal Encapsulation [19], L2TP [20], PPTP [21], L2F [25], UDP (e.g., [26]), ATMP [22], and IPv6-in-IPv4 [27] tunnels.

Extension MIBs may be designed for managing protocol-specific objects. Likewise, extension MIBs may be designed for managing security-specific objects (e.g., IPSEC [24]), and traffic conditioner [29] objects. Finally, this MIB does not support tunnels over non-IPv4 networks (including IPv6 networks). Management of such tunnels may be supported by other MIBs.

3. The SNMP Network Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in STD 58, RFC 2578 [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].

- A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

4. Overview

This MIB module contains two tables:

- the Tunnel Interface Table, containing information on the tunnels known to a router; and

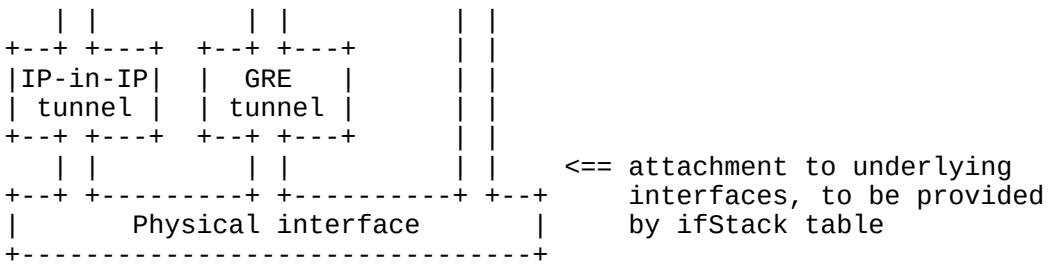
- the Tunnel Config Table, which can be used for dynamic creation of tunnels, and also provides a mapping from endpoint addresses to the current interface index value.

4.1. Relationship to the Interfaces MIB

This section clarifies the relationship of this MIB to the Interfaces MIB [23]. 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.

4.1.1. Layering Model

Each logical interface (physical or virtual) has an ifEntry in the Interfaces MIB [23]. 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):



4.1.2. ifRcvAddressTable

The ifRcvAddressTable usage is defined in the MIBs defining the encapsulation below the network layer. For example, if IP-in-IP encapsulation is being used, the ifRcvAddressTable is defined by IP-in-IP.

4.1.3. 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.

5. Definitions

```
TUNNEL-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, transmission,
    Integer32, IpAddress             FROM SNMPv2-SMI
    RowStatus                        FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP  FROM SNMPv2-CONF
    ifIndex, InterfaceIndexOrZero    FROM IF-MIB;

tunnelMIB MODULE-IDENTITY
    LAST-UPDATED "9908241200Z" -- August 24, 1999
    ORGANIZATION "IETF Interfaces MIB Working Group"
    CONTACT-INFO
            " Dave Thaler
              Microsoft Corporation
              One Microsoft Way
              Redmond, WA  98052-6399
              EMail: dthaler@dthaler.microsoft.com"
    DESCRIPTION
            "The MIB module for management of IP Tunnels, independent of
            the specific encapsulation scheme in use."
    REVISION     "9908241200Z" -- 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,
    tunnelIfRemoteAddress           IpAddress,
    tunnelIfEncapsMethod            INTEGER,
    tunnelIfHopLimit                Integer32,
    tunnelIfSecurity                INTEGER,
    tunnelIfTOS                     Integer32
}

tunnelIfLocalAddress OBJECT-TYPE
    SYNTAX     IpAddress
    MAX-ACCESS read-only
    STATUS     current
    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."
    ::= { tunnelIfEntry 1 }

tunnelIfRemoteAddress OBJECT-TYPE
    SYNTAX     IpAddress
    MAX-ACCESS read-only
    STATUS     current
    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."
    ::= { tunnelIfEntry 2 }

tunnelIfEncapsMethod OBJECT-TYPE
    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
```

```
                }
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
            "The encapsulation method used by the tunnel. The value
            direct indicates that the packet is encapsulated directly
            within a normal IPv4 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 remaining protocol-specific values indicate that
            a header of the protocol of that name is inserted between
            the outer header and the payload header."
    ::= { tunnelIfEntry 3 }

tunnelIfHopLimit OBJECT-TYPE
    SYNTAX     Integer32 (0..255)
    MAX-ACCESS read-write
    STATUS     current
    DESCRIPTION
            "The TTL 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 TOS 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 }

tunnelConfigTable OBJECT-TYPE
    SYNTAX     SEQUENCE OF TunnelConfigEntry
    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 tunnelConfigTable, regardless of
            whether it was created via SNMP."
    ::= { tunnel 2 }

tunnelConfigEntry OBJECT-TYPE
    SYNTAX     TunnelConfigEntry
    MAX-ACCESS not-accessible
    STATUS     current
    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            INTEGER,
    tunnelConfigID                      Integer32,
    tunnelConfigIfIndex                 InterfaceIndexOrZero,
    tunnelConfigStatus                  RowStatus
}

tunnelConfigLocalAddress OBJECT-TYPE
```

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

tunnelConfigEncapsMethod OBJECT-TYPE
    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)
               }
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The encapsulation method used by the tunnel."
    ::= { tunnelConfigEntry 3 }

tunnelConfigID 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."
```

```
    ::= { tunnelConfigEntry 4 }

tunnelConfigIfIndex OBJECT-TYPE
    SYNTAX     InterfaceIndexOrZero
    MAX-ACCESS read-only
    STATUS     current
    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     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
            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 }

-- conformance information

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

-- compliance statements

tunnelMIBCompliance MODULE-COMPLIANCE
    STATUS  current
    DESCRIPTION
            "The compliance statement for the IP Tunnel MIB."
    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 }

-- units of conformance

tunnelMIBBasicGroup OBJECT-GROUP
    OBJECTS { tunnelIfLocalAddress, tunnelIfRemoteAddress,
       tunnelIfEncapsMethod, tunnelIfHopLimit, tunnelIfTOS,
       tunnelIfSecurity, tunnelConfigIfIndex, tunnelConfigStatus }
    STATUS  current
    DESCRIPTION
            "A collection of objects to support basic management of IP
            Tunnels."
    ::= { tunnelMIBGroups 1 }
```

```
END
```

6. Security Considerations

This MIB contains readable objects whose values provide information related to IP tunnel interfaces. There are also a number of objects that have a MAX-ACCESS clause of read-write and/or read-create, such as those which allow an administrator to dynamically configure tunnels.

While unauthorized access to the readable objects is relatively innocuous, unauthorized access to the write-able objects could cause a denial of service, or could cause unauthorized creation and/or manipulation of tunnels. Hence, the support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

SNMPv1 by itself is such an insecure environment. Even if the network itself is secure (for example by using IPSec [24]), even then, there is no control as to who on the secure network is allowed to access and SET (change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to this MIB, is properly configured to give access to those objects only to those principals (users) that have legitimate rights to access 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.

8. Author's Address

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10. Intellectual Property Notice

11. Full Copyright Statement

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