

Network Working Group
Request for Comments: 4087
Obsoletes: 2667
Category: Standards Track

D. Thaler
Microsoft
June 2005

IP Tunnel MIB

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (2005).

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:

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

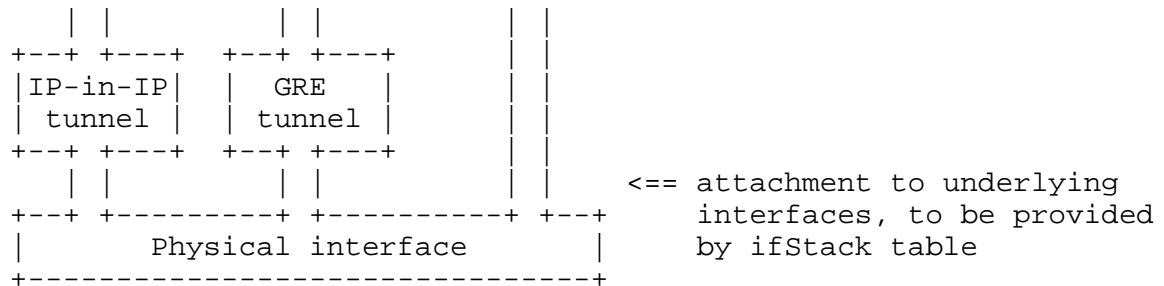
The version of this MIB module that appeared in RFC 2667 contained the Tunnel Config Table, which mapped IPv4 endpoint addresses to interface indexes. It is now deprecated in favor of the Tunnel Inet Config Table.

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]

IANA_tunnelType           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      IANA tunnelType,
    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 IANA_tunnelType

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      IANA tunnelType,
    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	IANAAtunnelType,
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 IANA_tunnelType
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
    }
```

Normative References

- [IFTYPE] Internet Assigned Numbers Authority, "IANAifType-MIB", <http://www.iana.org/assignments/ianaiftype-mib>.
- [RFC2473] Conta, A. and S. Deering, "Generic Packet Tunneling in IPv6 Specification", RFC 2473, December 1998.
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC2863] McCloghrie, K. and F. Kastenholz. "The Interfaces Group MIB", RFC 2863, June 2000.
- [RFC3595] Wijnen, B., "Textual Conventions for IPv6 Flow Label", RFC 3595, September 2003.
- [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", RFC 4001, February 2005.

Informative References

- [RFC1234] Provan, D., "Tunneling IPX Traffic through IP Networks", RFC 1234, June 1991.
- [RFC1241] Woodburn, R. and D. Mills, "A Scheme for an Internet Encapsulation Protocol: Version 1", RFC 1241, July 1991.
- [RFC1701] Hanks, S., Li, T., Farinacci, D., and P. Traina, "Generic Routing Encapsulation (GRE)", RFC 1701, October 1994.
- [RFC1702] Hanks, S., Li, T., Farinacci, D., and P. Traina, "Generic Routing Encapsulation over IPv4 networks", RFC 1702, October 1994.

- [RFC2003] Perkins, C., "IP Encapsulation within IP", RFC 2003, October 1996.
- [RFC2004] Perkins, C., "Minimal Encapsulation within IP", RFC 2004, October 1996.
- [RFC2107] Hamzeh, K., "Ascend Tunnel Management Protocol - ATMP", RFC 2107, February 1997.
- [RFC2341] Valencia, A., Littlewood, M., and T. Kolar. "Cisco Layer Two Forwarding (Protocol) "L2F"", RFC 2341, May 1998.
- [RFC2401] Kent, S. and R. Atkinson, "Security Architecture for the Internet Protocol", RFC 2401, November 1998.
- [RFC2474] Nichols, K., Blake, S., Baker, F., and D. Black. "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers", RFC 2474, December 1998.
- [RFC2637] Hamzeh, K., Pall, G., Verthein, W. Taarud, J., Little, W., and G. Zorn, "Point-to-Point Tunneling Protocol", RFC 2637, July 1999.
- [RFC2661] Townsley, W., Valencia, A., Rubens, A., Pall, G., Zorn, G., and B. Palter, "Layer Two Tunneling Protocol "L2TP"", RFC 2661, August 1999.
- [RFC2893] Gilligan, R. and E. Nordmark. "Transition Mechanisms for IPv6 Hosts and Routers", RFC 2893, August 2000.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

Author's Address

Dave Thaler
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Phone: +1 425 703 8835
EMail: dthaler@microsoft.com

Full Copyright Statement

Copyright (C) The Internet Society (2005).

This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

