

Network Working Group
Request for Comments: 3371
Category: Standards Track

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August 2002

Layer Two Tunneling Protocol "L2TP"
Management Information Base

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.

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing networks using Layer 2 Tunneling Protocol (L2TP).

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1.0 Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet Community. In particular, it describes managed objects used for managing L2TP devices.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2.0 The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [RFC2571].
- o 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 [RFC1155], STD 16, RFC 1212 [RFC1212] and RFC 1215 [RFC1215]. The second version, called SMIV2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

- o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].
- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].
- o A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

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.

3.0 Overview

The objects defined in this MIB are to be used when describing Layer Two Tunneling Protocol (L2TP) tunnels. The L2TP protocol is defined in [RFC2661]. This MIB consists of seven groups briefly described below:

l2tpConfigGroup

l2tpStatsGroup

These two groups of objects provide information on the configuration, state and statistics of the L2TP protocol, its tunnels and sessions. These groups are mandatory for implementors of this MIB.

l2tpDomainGroup

This optional group of objects provides configuration, state and statistical information for L2TP tunnel endpoint domains. A L2TP tunnel endpoint domain is considered to be a collection of L2TP devices typically belonging to a common administrative domain or geographic location.

l2tpMappingGroup

This optional group contains mapping tables to assist management applications to map between protocol identifiers and table indices.

l2tpIpUdpGroup

This group provides the state and statistics information for L2TP tunnels which are being transported by UDP/IP. This group is mandatory for L2TP implementations that support L2TP over UDP/IP.

l2tpSecurityGroup

This group is optional for SNMP agents which support both authentication and privacy of SNMP messages for the management of L2TP keys.

l2tpTrapGroup

This group contains the notifications that could be generated by a L2TP implementation.

l2tpHCPacketGroup

This group is optional for L2TP implementations that could potentially overflow the L2TP Domain tables 32-bit statistics counters in less than an hour.

3.1 Relationship to the Interface MIB

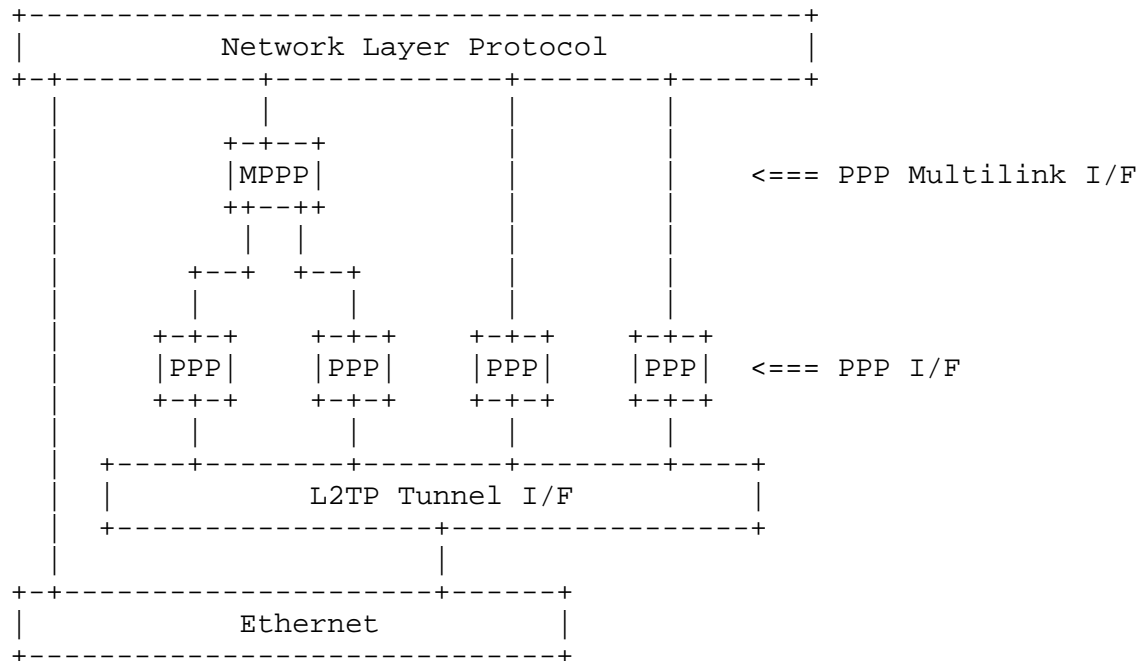
This section clarifies the relationship of this MIB to the Interfaces MIB [RFC2863]. Several areas of correlation are addressed in the following subsections. The implementor is referred to the Interfaces MIB document in order to understand the general intent of these areas.

3.1.1 Layering Model

This MIB contains several tables which are extensions to the IP Tunnel MIB described in [RFC2667] which itself defines extensions to the Interface MIB [RFC2863]. An L2TP tunnel is represented as a separate identifiable logical interface sub-layer. The tunnel stack layering model is described in [RFC2667].

In addition to that described in [RFC2667] an L2TP tunnel will not be at the top of the ifStack on a L2TP device that is acting as a L2TP Network Server (LNS). In this case PPP interfaces will be layered on top of the tunnel interface.

In the example diagram below, the interface layering is shown as it might appear at the LNS.



The ifStackTable is used to describe the layering of the interface sub-layers. For the example given above the ifTable and ifStackTable may appear as follows:

ifIndex	ifType	Tunnel MIB tables	Description
1	ethernetCsmacd(6)		Ethernet interface
2	tunnel(131)	tunnelIfTable l2tpTunnelConfigTable l2tpTunnelStatsTable	Tunnel interface
3	ppp(23)		PPP interface #1
4	ppp(23)		PPP interface #2
5	ppp(23)		PPP interface #3
6	ppp(23)		PPP interface #4
7	mlppp(108)		MLPPP interface

The corresponding ifStack table entries would then be:

ifStackTable Entries

HigherLayer	LowerLayer
0	5
0	6
0	7
1	0
2	1
3	2
4	2
5	2
6	2
7	3
7	4

L2TP Access Concentrator (LAC) tunnel interfaces on the other hand appear at the top of the interface layering stack. In this case the layering model is as described in [RFC2667].

However in order to support the tunneling of packets received from interfaces carrying framed PPP packets on the LAC to the LNS (and the propagation of decapsulated PPP packets to that interface) additional configuration is required. This is further described in section 3.4.

3.1.2 Interface MIB Objects

Except where noted in the tables below, all objects MUST be supported from the ifGeneralInformationGroup and one of the following three groups:

- o ifPacketGroup OR
- o ifHCPacketGroup OR
- o ifVHCPacketGroup

depending on the particular implementation.

The following tables describe how objects from the ifGeneralInformationGroup and ifPacketGroup (similar support should be provided for the high and very high capacity packet groups) are to be interpreted and supported for L2TP tunnel interfaces.

3.1.2.1 L2TP Tunnel Interfaces

All Interface MIB objects not listed in the above groups for L2TP tunnel interfaces MUST be supported as described in [RFC2863].

Interface MIB Object =====	Support Description =====
ifTable.ifDescr	Refer to the Interface MIB.
ifTable.ifType	tunnel(131).
ifTable.ifMtu	Dependent on the tunnel transport layer. For UDP/IP transports the MTU should be 65467 (65535-60(IP)-8(UDP)).
ifTable.ifSpeed	Return zero.
ifTable.ifPhyAddress	The assigned tunnel identifier.
ifTable.ifAdminStatus	Setting ifAdminStatus to 'up' injects a 'Local Open' request into the tunnel FSM. Setting ifAdminStatus to 'down' injects a 'Tunnel Close' event into the tunnel FSM. Setting ifAdminStatus to 'testing' is not currently defined but could be used to test tunnel connectivity.
ifTable.ifOperStatus	ifOperStatus values are to be interpreted as follows: <ul style="list-style-type: none"> 'up' - tunnel is established. 'down' - administratively down or peer unreachable. 'testing' - in some test mode. 'unknown' - status cannot be determined for some reason. 'dormant' - operational but waiting for local or remote trigger to bring up the tunnel. 'notPresent' - configuration missing. 'lowerLayerDown' - down due to state of lower-layer interface(s).
ifTable.ifInOctets	The total number of octets received on the tunnel including control and payload octets.
ifTable.ifInUcastPkts	The total number of packets received on the tunnel including control and payload packets.

ifTable.ifInDiscards	The total number of received packets that were discarded on both control and payload channels.
ifTable.ifInErrors	The total number of packets received in error including control and payload packets.
ifTable.ifInUnknownProtos	Return zero.
ifTable.ifOutOctets	The total number of octets transmitted from the tunnel including control and payload octets.
ifTable.ifOutUcastPkts	The total number of packets transmitted from the tunnel including control and payload packets.
ifTable.ifOutDiscards	The total number of discarded packets that were requested to be transmitted including control and payload packets.
ifTable.ifOutErrors	The total number of packets that were requested to be transmitted that were in error including control and payload packets.
ifXTable.ifName	Refer to the Interface MIB.
ifXTable.ifInMulticastPkts	Return zero.
ifXTable.ifInBroadcastPkts	Return zero.
ifXTable.ifOutMulticastPkts	Return zero.
ifXTable.ifOutBroadcastPkts	Return zero.
ifXTable.ifOutBroadcastPkts	Return zero.
ifXTable.ifLinkUpDownTrapEnable	Default set to enabled(1).

```
ifXTable.ifHighSpeed      Return zero.

ifXTable.ifPromiscuousMode
                          Set to false(2).

ifXTable.ifConnectorPresent
                          Set to false(2).
```

3.2 Relationship to other MIBs

3.2.1 Relationship to the IP Tunnel MIB

The IP Tunnel MIB [RFC2667] describes tunnel interfaces that have an ifType of tunnel(131). The IP Tunnel MIB is considered to contain a collection of objects common to all IP tunneling protocols, including L2TP. In addition to the IP Tunnel MIB, tunnel encapsulation specific MIBs (like this MIB) extend the IP Tunnel MIB to further describe encapsulation specific information. Implementation of the IP Tunnel MIB is required for L2TP tunnels over IP.

3.3 L2TP Tunnel Creation

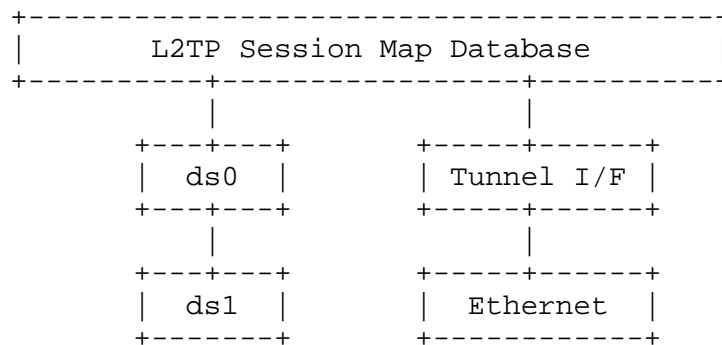
Tunnel creation is detailed for tunnels over IP in the IP Tunnel MIB. The creation of a tunnelIfEntry in [RFC2667] when the encapsulation method is "l2tp" will have the side effect of creating entries in the l2tpTunnelConfigTable, l2tpTunnelStatsTable and the l2tpUdpStatsTable's.

The creation of L2TP tunnel interfaces over transports other than IP is expected to be defined in the MIB definition for that specific L2TP tunnel transport.

3.4 L2TP Session Mapping

The l2tpSessionMapTable table allows management applications to determine which session within a tunnel a particular interface (either a PPP or DS0 interface) is mapped to. On the LAC it also provides a management application the ability to map a particular physical or virtual interface terminating a PPP link to a particular L2TP tunnel. This is required since the interface stacking as performed (and instrumented by the ifStackTable) on the LNS cannot be applied at the LAC.

The following diagram illustrates the conceptual binding that occurs.



The stacking of the individual interface stacks would be described by the ifStackTable.

4.0 L2TP Object Definitions

```
L2TP-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```

Integer32, Unsigned32, Counter32, Gauge32,
Counter64, transmission, MODULE-IDENTITY,
OBJECT-TYPE, NOTIFICATION-TYPE
    FROM SNMPv2-SMI
TEXTUAL-CONVENTION, RowStatus, TruthValue,
StorageType
    FROM SNMPv2-TC
SnmpAdminString
    FROM SNMP-FRAMEWORK-MIB
OBJECT-GROUP, MODULE-COMPLIANCE, NOTIFICATION-GROUP
    FROM SNMPv2-CONF
InterfaceIndex
    FROM IF-MIB;
```

```

l2tp  MODULE-IDENTITY
LAST-UPDATED   "200208230000Z" -- 23 August 2002
ORGANIZATION   "IETF L2TP Working Group"
CONTACT-INFO
    "Evan Caves
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Layer Two Tunneling Protocol Extensions WG
Working Group Area: Internet
Working Group Name: l2tpext
General Discussion: l2tp@l2tp.net"

DESCRIPTION

"The MIB module that describes managed objects of
general use by the Layer Two Transport Protocol."

-- revision log

REVISION "200208230000Z" -- 23 August 2002

DESCRIPTION

"First revision, published as RFC 3371."

::= { transmission 95 }

--
--
--

Textual Conventions

L2tpMilliSeconds ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d-3"

STATUS current

DESCRIPTION

"A period of time measured in units of .001 of seconds
when used in conjunction with the DISPLAY-HINT will
show seconds and fractions of second with a resolution
of .001 of a second."

SYNTAX Integer32 (0..2147483646)

--
--
--

Definitions of significant branches

```

l2tpNotifications OBJECT IDENTIFIER ::= { l2tp 0 }
l2tpObjects       OBJECT IDENTIFIER ::= { l2tp 1 }
l2tpTransports    OBJECT IDENTIFIER ::= { l2tp 3 }
l2tpConformance   OBJECT IDENTIFIER ::= { l2tp 4 }

--
--       Definitions of significant branches under l2tpObjects
--
l2tpScalar        OBJECT IDENTIFIER ::= { l2tpObjects 1 }
l2tpConfig        OBJECT IDENTIFIER ::= { l2tpScalar 1 }
l2tpStats         OBJECT IDENTIFIER ::= { l2tpScalar 2 }

--
--       Definitions of significant branches under l2tpTransports
--
--       Note that future transports of L2TP (e.g.: Frame relay)
--       should create their own branch under l2tpTransports.

l2tpTransportIpUdp OBJECT IDENTIFIER ::= { l2tpTransports 1 }
l2tpIpUdpObjects   OBJECT IDENTIFIER ::= { l2tpTransportIpUdp 1 }
l2tpIpUdpTraps     OBJECT IDENTIFIER ::= { l2tpTransportIpUdp 2 }

--
--       The L2TP Scalar Configuration Group
--
--       This group of objects is used to manage configuration
--       of the L2TP protocol environment.

l2tpAdminState     OBJECT-TYPE
    SYNTAX          INTEGER {
                        enabled(1),
                        disabled(2)
                    }
    MAX-ACCESS       read-write
    STATUS           current
    DESCRIPTION
        "This object defines the administrative state of
        the L2TP protocol. Setting this object to
        'disabled' causes all tunnels to be immediately
        disconnected and no further tunnels to be either
        initiated or accepted. The value of this object
        must be maintained in non-volatile memory."
    ::= { l2tpConfig 1 }

l2tpDrainTunnels   OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS       read-write
    STATUS           current

```

DESCRIPTION

"Setting this object to 'true' will prevent any new tunnels and/or sessions to be either initiated or accepted but does NOT disconnect any active tunnels/sessions. Setting this object to true(1) causes all domains and their respective tunnels to transition to the draining state. Note that when this occurs the 'xxxDraining' status objects of the domains and their tunnels should reflect that they are 'draining'. Setting this object has no affect on the domains or their tunnels 'xxxDrainTunnels' configuration objects. To cancel a drain this object should be set to false(2). The object l2tpDrainingTunnels reflects the current L2TP draining state. The value of this object must be maintained in non-volatile memory."

```
::= { l2tpConfig 2 }
```

```
--
```

```
-- The L2TP Scalar Status and Statistics Group
```

```
--
```

```
-- This group of objects describe the current state and
-- statistics of L2TP.
```

```
l2tpProtocolVersions      OBJECT-TYPE
    SYNTAX                 OCTET STRING (SIZE(2..256))
    MAX-ACCESS             read-only
    STATUS                 current
    DESCRIPTION
        "Vector of supported L2TP protocol version and
        revision numbers. Supported versions are identified
        via a two octet pairing where the first octet indicates
        the version and the second octet contains the revision."
    ::= { l2tpStats 1 }
```

```
l2tpVendorName            OBJECT-TYPE
    SYNTAX                 SnmpAdminString
    MAX-ACCESS             read-only
    STATUS                 current
    DESCRIPTION
        "This object identifies the Vendor name of the L2TP
        protocol stack."
    ::= { l2tpStats 2 }
```

```
l2tpFirmwareRev           OBJECT-TYPE
    SYNTAX                 Integer32
    MAX-ACCESS             read-only
```

```

STATUS          current
DESCRIPTION
    "This object defines the firmware revision for the
      L2TP protocol stack."
 ::= { l2tpStats 3 }

l2tpDrainingTunnels OBJECT-TYPE
SYNTAX          TruthValue
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object indicates if the local L2TP is draining
      off sessions from all tunnels."
 ::= { l2tpStats 4 }

--
-- The L2TP Domain Configuration Table
--

l2tpDomainConfigTable OBJECT-TYPE
SYNTAX          SEQUENCE OF L2tpDomainConfigEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "The L2TP Domain configuration table. This table
      contains objects that can be used to configure
      the operational characteristics of a tunnel
      domain. There is a 1-1 correspondence between
      conceptual rows of this table and conceptual
      rows of the l2tpDomainStatsTable."
 ::= { l2tpObjects 2 }

l2tpDomainConfigEntry OBJECT-TYPE
SYNTAX          L2tpDomainConfigEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "An L2TP Domain configuration entry. An entry in this
      table may correspond to a single endpoint or a group
      of tunnel endpoints."
INDEX { l2tpDomainConfigId }
 ::= { l2tpDomainConfigTable 1 }

L2tpDomainConfigEntry ::=
SEQUENCE {
    l2tpDomainConfigId
        SnmpAdminString,
    l2tpDomainConfigAdminState

```

```

        INTEGER,
12tpDomainConfigDrainTunnels
        TruthValue,
12tpDomainConfigAuth
        INTEGER,
12tpDomainConfigSecret
        SnmpAdminString,
12tpDomainConfigTunnelSecurity
        INTEGER,
12tpDomainConfigTunnelHelloInt
        Integer32,
12tpDomainConfigTunnelIdleTO
        Integer32,
12tpDomainConfigControlRWS
        Integer32,
12tpDomainConfigControlMaxRetx
        Integer32,
12tpDomainConfigControlMaxRetxTO
        Integer32,
12tpDomainConfigPayloadSeq
        INTEGER,
12tpDomainConfigReassemblyTO
        L2tpMilliSeconds,
12tpDomainConfigProxyPPPAuth
        TruthValue,
12tpDomainConfigStorageType
        StorageType,
12tpDomainConfigStatus
        RowStatus
    }

```

12tpDomainConfigId OBJECT-TYPE

```

SYNTAX      SnmpAdminString (SIZE (1..80))
MAX-ACCESS  not-accessible
STATUS      current

```

DESCRIPTION

"The identifier, usually in the form of a Domain Name (full or partial), describing a single tunnel endpoint or a domain of tunnel endpoints. This is typically used as a 'handle' to identify the tunnel configuration requirements for both incoming and outgoing tunnel connection attempts. Both the LAC and LNS could use information provided in the Host Name AVP attribute however the tunnel initiator could use other means not specified to identify the domain's tunnel configuration requirements. For example; three rows in this table have 12tpDomainConfigId values of 'lac1.isp.com',

'isp.com' and 'com'. A tunnel endpoint then identifies itself as 'lac1.isp.com' which would match the 'lac1.isp.com' entry in this table. A second tunnel endpoint then identifies itself as 'lac2.isp.com'. This endpoint is then associated with the 'isp.com' entry of this table."

```
::= { l2tpDomainConfigEntry 1 }
```

l2tpDomainConfigAdminState OBJECT-TYPE

```
SYNTAX          INTEGER {
                    enabled(1),
                    disabled(2)
                }
```

```
MAX-ACCESS      read-create
```

```
STATUS          current
```

DESCRIPTION

"This object defines the administrative state of this tunnel domain. Setting this object to disabled(2) causes all tunnels to be immediately disconnected and no further tunnels to be either initiated or accepted. Note that all columnar objects corresponding to this conceptual row cannot be modified when the administrative state is enabled EXCEPT those objects which specifically state otherwise."

```
DEFVAL { enabled }
```

```
::= { l2tpDomainConfigEntry 2 }
```

l2tpDomainConfigDrainTunnels OBJECT-TYPE

```
SYNTAX          TruthValue
```

```
MAX-ACCESS      read-create
```

```
STATUS          current
```

DESCRIPTION

"Setting this object to 'true' will prevent any new tunnels and/or sessions from being either initiated or accepted but does NOT disconnect any active tunnels/sessions for this tunnel domain. Setting this object to true(1) causes all tunnels within this domain to transition to the draining state. Note that when this occurs the l2tpTunnelStatsDrainingTunnel status objects of all of this domain's tunnels should reflect that they are 'draining'. Setting this object has no effect on this domain's associated tunnels l2tpTunnelConfigDrainTunnel configuration objects. To cancel a drain this object should be set to false(2). Setting this object to false(2) when the L2TP object l2tpDrainTunnels is true(1) has no affect, all domains and their tunnels will

```

        continue to drain."
    DEFVAL { false }
    ::= { l2tpDomainConfigEntry 3 }

l2tpDomainConfigAuth OBJECT-TYPE
    SYNTAX          INTEGER {
                        none(1),
                        simple(2),
                        challenge(3)
                    }
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object describes how tunnel peers belonging
        to this domain are to be authenticated. The value
        simple(2) indicates that peers are authenticated
        simply by their host name as described in the Host
        Name AVP. The value challenge(3) indicates that
        all peers are challenged to prove their identification.
        This mechanism is described in the L2TP protocol."
    REFERENCE "RFC 2661 Section 5.1"
    DEFVAL { none }
    ::= { l2tpDomainConfigEntry 4 }

l2tpDomainConfigSecret OBJECT-TYPE
    SYNTAX          SnmpAdminString (SIZE (0..255))
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object is used to configure the shared secret
        used during the tunnel authentication phase of
        tunnel establishment. This object MUST be accessible
        only via requests using both authentication and
        privacy. The agent MUST report an empty string in
        response to get, get-next and get-bulk requests."
    ::= { l2tpDomainConfigEntry 5 }

l2tpDomainConfigTunnelSecurity OBJECT-TYPE
    SYNTAX          INTEGER {
                        none(1),
                        other(2),
                        ipSec(3)
                    }
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object defines whether this tunnel domain
        requires that all tunnels are to be secured. The

```

value of ipsec(3) indicates that all tunnel packets, control and session, have IP Security headers. The type of IP Security headers (AH, ESP etc) and how they are further described is outside the scope of this document."

```
DEFVAL { none }
 ::= { l2tpDomainConfigEntry 6 }
```

l2tpDomainConfigTunnelHelloInt OBJECT-TYPE

```
SYNTAX      Integer32 (0..3600)
UNITS       "seconds"
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"This object defines the interval in which Hello (or keep-alive) packets are to be sent by local peers belonging to this tunnel domain. The value zero effectively disables the sending of Hello packets. This object may be modified when the administrative state is enabled for this conceptual row."

```
DEFVAL { 60 }
 ::= { l2tpDomainConfigEntry 7 }
```

l2tpDomainConfigTunnelIdleTO OBJECT-TYPE

```
SYNTAX      Integer32 (-1..86400)
UNITS       "seconds"
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"This object defines the period of time that an established tunnel belonging to this tunnel domain with no active sessions will wait before disconnecting the tunnel. A value of zero indicates that the tunnel will disconnect immediately after the last session disconnects. A value of -1 leaves the tunnel up indefinitely. This object may be modified when the administrative state is enabled for this conceptual row."

```
DEFVAL { 0 }
 ::= { l2tpDomainConfigEntry 8 }
```

l2tpDomainConfigControlRWS OBJECT-TYPE

```
SYNTAX      Integer32 (1..65535)
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"This object defines the control channel receive

window size for tunnels belonging to this domain. It specifies the maximum number of packets the tunnel peer belonging to this domain can send without waiting for an acknowledgement from this peer."

```
DEFVAL { 4 }
::= { l2tpDomainConfigEntry 9 }
```

l2tpDomainConfigControlMaxRetx OBJECT-TYPE

```
SYNTAX      Integer32 (0..32)
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"This object defines the maximum number of retransmissions which the L2TP stack will attempt for tunnels belonging to this domain before assuming that the peer is no longer responding."

```
DEFVAL { 5 }
::= { l2tpDomainConfigEntry 10 }
```

l2tpDomainConfigControlMaxRetxTO OBJECT-TYPE

```
SYNTAX      Integer32 (1..32)
UNITS       "seconds"
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"This object defines the maximum retransmission timeout interval which the L2TP stack will wait for tunnels belonging to this domain before retransmitting a control packet that has not been acknowledged."

```
DEFVAL { 16 }
::= { l2tpDomainConfigEntry 11 }
```

l2tpDomainConfigPayloadSeq OBJECT-TYPE

```
SYNTAX      INTEGER {
                    onDemand(1),
                    never(2),
                    always(3)
                }
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

DESCRIPTION

"This object determines whether or not session payload packets will be requested to be sent with sequence numbers from tunnel peers belonging to this domain. The value onDemand(1) allows the L2TP implementation to initiate payload sequencing when necessary based on local information (e.g: during LCP/NCP negotiations or for CCP). The value never(2) indicates that L2TP

will never initiate sequencing but will do sequencing if asked. The value always(3) indicates that L2TP will send the Sequencing Required AVP during session establishment."

```
DEFVAL { onDemand }
::= { l2tpDomainConfigEntry 12 }
```

l2tpDomainConfigReassemblyTO OBJECT-TYPE

```
SYNTAX          L2tpMilliseconds
MAX-ACCESS      read-create
STATUS          current
```

DESCRIPTION

"This object defines the number of milliseconds that local peers of this tunnel domain will wait before processing payload packets that were received out of sequence (which are waiting for the packet(s) to put them in sequence). A low value increases the chance of delayed packets to be discarded (which MAY cause the PPP decompression engine to reset) while a high value may cause more queuing and possibly degrade throughput if packets are truly lost. The default value for this object is zero which will result in all delayed packets being lost."

```
DEFVAL { 0 }
::= { l2tpDomainConfigEntry 13 }
```

l2tpDomainConfigProxyPPPAuth OBJECT-TYPE

```
SYNTAX          TruthValue
MAX-ACCESS      read-create
STATUS          current
```

DESCRIPTION

"This object is used to configure the sending or acceptance of the PPP Proxy Authentication AVP's on the LAC or LNS."

```
DEFVAL { true }
::= { l2tpDomainConfigEntry 14 }
```

l2tpDomainConfigStorageType OBJECT-TYPE

```
SYNTAX          StorageType
MAX-ACCESS      read-create
STATUS          current
```

DESCRIPTION

"The storage type for this conceptual row.

Conceptual rows having the value 'permanent' must allow write-access at a minimum to:

- l2tpDomainConfigAdminState and

l2tpDomainConfigDrainTunnels at all times
 - l2tpDomainConfigSecret if l2tpDomainConfigAuth
 has been configured as 'challenge'

It is an implementation issue to decide if a SET for
 a readOnly or permanent row is accepted at all. In some
 contexts this may make sense, in others it may not. If
 a SET for a readOnly or permanent row is not accepted
 at all, then a 'wrongValue' error must be returned."

::= { l2tpDomainConfigEntry 15 }

l2tpDomainConfigStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this Domain entry. Columnar objects
 corresponding to this conceptual row may be modified
 according to their description clauses when this
 RowStatus object is 'active'."

::= { l2tpDomainConfigEntry 16 }

--

-- The L2TP Domain Status and Statistics Table

--

l2tpDomainStatsTable OBJECT-TYPE

SYNTAX SEQUENCE OF L2tpDomainStatsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The L2TP Domain Status and Statistics table. This
 table contains objects that can be used to describe
 the current status and statistics of a tunnel domain.
 There is a 1-1 correspondence between conceptual
 rows of this table and conceptual rows of the
 l2tpDomainConfigTable."

::= { l2tpObjects 3 }

l2tpDomainStatsEntry OBJECT-TYPE

SYNTAX L2tpDomainStatsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An L2TP Domain Stats entry. An entry in this table
 may correspond to a single endpoint or a group of
 tunnel endpoints."

AUGMENTS { l2tpDomainConfigEntry }

```
::= { l2tpDomainStatsTable 1 }
```

```
L2tpDomainStatsEntry ::=
  SEQUENCE {
    l2tpDomainStatsTotalTunnels
      Counter32,
    l2tpDomainStatsFailedTunnels
      Counter32,
    l2tpDomainStatsFailedAuths
      Counter32,
    l2tpDomainStatsActiveTunnels
      Gauge32,
    l2tpDomainStatsTotalSessions
      Counter32,
    l2tpDomainStatsFailedSessions
      Counter32,
    l2tpDomainStatsActiveSessions
      Gauge32,
    l2tpDomainStatsDrainingTunnels
      TruthValue,
    l2tpDomainStatsControlRxOctets
      Counter32,
    l2tpDomainStatsControlRxPkts
      Counter32,
    l2tpDomainStatsControlTxOctets
      Counter32,
    l2tpDomainStatsControlTxPkts
      Counter32,
    l2tpDomainStatsPayloadRxOctets
      Counter32,
    l2tpDomainStatsPayloadRxPkts
      Counter32,
    l2tpDomainStatsPayloadRxDiscs
      Counter32,
    l2tpDomainStatsPayloadTxOctets
      Counter32,
    l2tpDomainStatsPayloadTxPkts
      Counter32,
    l2tpDomainStatsControlHCRxOctets
      Counter64,
    l2tpDomainStatsControlHCRxPkts
      Counter64,
    l2tpDomainStatsControlHCTxOctets
      Counter64,
    l2tpDomainStatsControlHCTxPkts
      Counter64,
    l2tpDomainStatsPayloadHCRxOctets
      Counter64,
```

```

        12tpDomainStatsPayloadHCRxPkts
            Counter64,
        12tpDomainStatsPayloadHCRxDiscs
            Counter64,
        12tpDomainStatsPayloadHCTxOctets
            Counter64,
        12tpDomainStatsPayloadHCTxPkts
            Counter64
    }

12tpDomainStatsTotalTunnels OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the total number of tunnels
         that have successfully reached the established
         state for this tunnel domain."
    ::= { 12tpDomainStatsEntry 1 }

12tpDomainStatsFailedTunnels OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of tunnels that
         failed (eg: connection timeout, unsupported
         or malformed AVP's etc) to reach the established
         state for this tunnel domain."
    ::= { 12tpDomainStatsEntry 2 }

12tpDomainStatsFailedAuths OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of failed tunnel
         connection attempts for this domain because the
         tunnel peer failed authentication."
    ::= { 12tpDomainStatsEntry 3 }

12tpDomainStatsActiveTunnels OBJECT-TYPE
    SYNTAX          Gauge32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of tunnels that
         are currently active for this domain."

```

```
::= { l2tpDomainStatsEntry 4 }
```

l2tpDomainStatsTotalSessions OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object returns the total number of sessions that have successfully reached the established state for this tunnel domain."

```
::= { l2tpDomainStatsEntry 5 }
```

l2tpDomainStatsFailedSessions OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object returns the number of sessions that failed (eg: connection timeout, unsupported or malformed AVP's etc) to reach the established state for this tunnel domain."

```
::= { l2tpDomainStatsEntry 6 }
```

l2tpDomainStatsActiveSessions OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object returns the number of sessions that are currently active for this domain."

```
::= { l2tpDomainStatsEntry 7 }
```

l2tpDomainStatsDrainingTunnels OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object indicates if this domain is draining off sessions from all tunnels."

```
::= { l2tpDomainStatsEntry 8 }
```

l2tpDomainStatsControlRxOctets OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object returns the number of control channel octets received for this tunnel domain."

```
::= { l2tpDomainStatsEntry 9 }
```

```
l2tpDomainStatsControlRxPkts OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This object returns the number of control packets  
received for this tunnel domain."
```

```
::= { l2tpDomainStatsEntry 10 }
```

```
l2tpDomainStatsControlTxOctets OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This object returns the number of control channel  
octets that were transmitted to tunnel endpoints  
for this domain."
```

```
::= { l2tpDomainStatsEntry 11 }
```

```
l2tpDomainStatsControlTxPkts OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This object returns the number of control packets  
that were transmitted to tunnel endpoints for  
this domain."
```

```
::= { l2tpDomainStatsEntry 12 }
```

```
l2tpDomainStatsPayloadRxOctets OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This object returns the number of payload channel  
octets that were received for this tunnel domain."
```

```
::= { l2tpDomainStatsEntry 13 }
```

```
l2tpDomainStatsPayloadRxPkts OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This object returns the number of payload packets  
that were received for this tunnel domain."
```

```
::= { l2tpDomainStatsEntry 14 }
```

```
12tpDomainStatsPayloadRxDiscs OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of received payload
        packets that were discarded by this tunnel domain."
    ::= { 12tpDomainStatsEntry 15 }

12tpDomainStatsPayloadTxOctets OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of payload channel
        octets that were transmitted to tunnel peers
        within this tunnel domain."
    ::= { 12tpDomainStatsEntry 16 }

12tpDomainStatsPayloadTxPkts OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object returns the number of payload packets
        that were transmitted to tunnel peers within
        this tunnel domain."
    ::= { 12tpDomainStatsEntry 17 }

--
-- High Capacity Counter objects.  These objects are all
-- 64 bit versions of the above 32-bit counters.  These
-- objects all have the same basic semantics as their
-- 32-bit counterparts, however, their syntax has been
-- extended to 64 bits.
--

12tpDomainStatsControlHCRxOctets OBJECT-TYPE
    SYNTAX          Counter64
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object is a 64-bit version of
        12tpDomainStatsControlRxOctets."
    ::= { 12tpDomainStatsEntry 18 }

12tpDomainStatsControlHCRxPkts OBJECT-TYPE
    SYNTAX          Counter64
```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object is a 64-bit version of
l2tpDomainStatsControlRxPkts."
::= { l2tpDomainStatsEntry 19 }

l2tpDomainStatsControlHCTxOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object is a 64-bit version of
l2tpDomainStatsControlTxOctets."
::= { l2tpDomainStatsEntry 20 }

l2tpDomainStatsControlHCTxPkts OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object is a 64-bit version of
l2tpDomainStatsControlTxPkts."
::= { l2tpDomainStatsEntry 21 }

l2tpDomainStatsPayloadHCRxOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object is a 64-bit version of
l2tpDomainStatsPayloadRxOctets."
::= { l2tpDomainStatsEntry 22 }

l2tpDomainStatsPayloadHCRxPkts OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object is a 64-bit version of
l2tpDomainStatsPayloadRxPkts."
::= { l2tpDomainStatsEntry 23 }

l2tpDomainStatsPayloadHCRxDiscs OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"This object is a 64-bit version of
 l2tpDomainStatsPayloadRxDiscs."
 ::= { l2tpDomainStatsEntry 24 }

l2tpDomainStatsPayloadHCTxOctets OBJECT-TYPE
 SYNTAX Counter64
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This object is a 64-bit version of
 l2tpDomainStatsPayloadTxOctets."
 ::= { l2tpDomainStatsEntry 25 }

l2tpDomainStatsPayloadHCTxPkts OBJECT-TYPE
 SYNTAX Counter64
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This object is a 64-bit version of
 l2tpDomainStatsPayloadTxPkts."
 ::= { l2tpDomainStatsEntry 26 }

--
 -- The L2TP Tunnel Configuration Table
 --

l2tpTunnelConfigTable OBJECT-TYPE
 SYNTAX SEQUENCE OF L2tpTunnelConfigEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "The L2TP tunnel configuration table. This
 table contains objects that can be used to
 (re)configure the operational characteristics
 of a single L2TP tunnel. There is a 1-1
 correspondence between conceptual rows of
 this table and conceptual rows of the
 l2tpTunnelStatsTable. Entries in this table
 have the same persistency characteristics as
 that of the tunnelConfigTable."
 REFERENCE "RFC 2667"
 ::= { l2tpObjects 4 }

l2tpTunnelConfigEntry OBJECT-TYPE
 SYNTAX L2tpTunnelConfigEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"A L2TP tunnel interface configuration entry. Entries in this table come and go as a result of protocol interactions or on management operations. The latter occurs when a row is instantiated in the tunnelConfigTable row and the encapsulation method is 'l2tp'."

REFERENCE "RFC 2667"

INDEX { l2tpTunnelConfigIfIndex }
 ::= { l2tpTunnelConfigTable 1 }

```
L2tpTunnelConfigEntry ::=
  SEQUENCE {
    l2tpTunnelConfigIfIndex
      InterfaceIndex,
    l2tpTunnelConfigDomainId
      SnmpAdminString,
    l2tpTunnelConfigAuth
      INTEGER,
    l2tpTunnelConfigSecret
      SnmpAdminString,
    l2tpTunnelConfigSecurity
      INTEGER,
    l2tpTunnelConfigHelloInterval
      Integer32,
    l2tpTunnelConfigIdleTimeout
      Integer32,
    l2tpTunnelConfigControlRWS
      Integer32,
    l2tpTunnelConfigControlMaxRetx
      Integer32,
    l2tpTunnelConfigControlMaxRetxTO
      Integer32,
    l2tpTunnelConfigPayloadSeq
      INTEGER,
    l2tpTunnelConfigReassemblyTO
      L2tpMilliSeconds,
    l2tpTunnelConfigTransport
      INTEGER,
    l2tpTunnelConfigDrainTunnel
      TruthValue,
    l2tpTunnelConfigProxyPPPAAuth
      TruthValue
  }
```

```
l2tpTunnelConfigIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS   not-accessible
    STATUS      current
```

DESCRIPTION

"This value for this object is equal to the value of ifIndex of the Interfaces MIB for tunnel interfaces of type L2TP."

::= { l2tpTunnelConfigEntry 1 }

l2tpTunnelConfigDomainId OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (1..80))

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The tunnel domain that this tunnel belongs to. A LNS tunnel endpoint will typically inherit this value from the endpoint domain table. A LAC may be provided with this information during tunnel setup. When a zero length string is returned this tunnel does not belong to any particular domain."

::= { l2tpTunnelConfigEntry 2 }

l2tpTunnelConfigAuth OBJECT-TYPE

SYNTAX INTEGER {
none(1),
simple(2),
challenge(3)
}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object describes how L2TP tunnel peers are to be authenticated. The value 'simple' indicates that peers are authenticated simply by their host name as described in the Host Name AVP. The value 'challenge' indicates that all peers are challenged to prove their identification. This mechanism is described in the L2TP protocol. This object cannot be modified when the tunnel is in a connecting or connected state."

DEFVAL { none }

::= { l2tpTunnelConfigEntry 3 }

l2tpTunnelConfigSecret OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..255))

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object is used to configure the shared secret used during the tunnel authentication phase of

tunnel establishment. This object cannot be modified when the tunnel is in a connecting or connected state. This object MUST be accessible only via requests using both authentication and privacy. The agent MUST report an empty string in response to get, get-next and get-bulk requests."

```
::= { l2tpTunnelConfigEntry 4 }
```

l2tpTunnelConfigSecurity OBJECT-TYPE

```
SYNTAX          INTEGER {
                    none(1),
                    other(2),
                    ipsec(3)
                }
```

```
MAX-ACCESS      read-write
```

```
STATUS          current
```

DESCRIPTION

"This object defines whether this tunnel is to be secured. The value of 'ipSec' indicates that all tunnel packets, control and session, have IP Security headers. The type of IP Security headers (AH, ESP etc) and how they are further described is outside the scope of this document. This object cannot be modified when the tunnel is in a connecting or connected state."

```
DEFVAL { none }
```

```
::= { l2tpTunnelConfigEntry 5 }
```

l2tpTunnelConfigHelloInterval OBJECT-TYPE

```
SYNTAX          Integer32 (0..3600)
```

```
UNITS           "seconds"
```

```
MAX-ACCESS      read-write
```

```
STATUS          current
```

DESCRIPTION

"This object defines the interval in which Hello (or keep-alive) packets are to be sent to the tunnel peer. The value zero effectively disables the sending of Hello packets. Modifications to this object have immediate effect."

```
DEFVAL { 60 }
```

```
::= { l2tpTunnelConfigEntry 6 }
```

l2tpTunnelConfigIdleTimeout OBJECT-TYPE

```
SYNTAX          Integer32 (-1..86400)
```

```
UNITS           "seconds"
```

```
MAX-ACCESS      read-write
```

```
STATUS          current
```

DESCRIPTION

"This object defines the period of time that an established tunnel with no sessions will wait before disconnecting the tunnel. A value of zero indicates that the tunnel will disconnect immediately after the last session disconnects. A value of -1 leaves the tunnel up indefinitely. Modifications to this object have immediate effect."

DEFVAL { 0 }
::= { l2tpTunnelConfigEntry 7 }

l2tpTunnelConfigControlRWS OBJECT-TYPE

SYNTAX Integer32 (1..65535)
MAX-ACCESS read-write
STATUS current
DESCRIPTION

"This object defines the control channel receive window size. It specifies the maximum number of packets the tunnel peer can send without waiting for an acknowledgement from this peer. This object cannot be modified when the tunnel is in a connecting or connected state."

DEFVAL { 4 }
::= { l2tpTunnelConfigEntry 8 }

l2tpTunnelConfigControlMaxRetx OBJECT-TYPE

SYNTAX Integer32 (0..32)
MAX-ACCESS read-write
STATUS current
DESCRIPTION

"This object defines the number of retransmissions which the tunnel will attempt before assuming that the peer is no longer responding. A value of zero indicates that this peer will not attempt to retransmit an unacknowledged control packet. Modifications to this object have immediate effect."

DEFVAL { 5 }
::= { l2tpTunnelConfigEntry 9 }

l2tpTunnelConfigControlMaxRetxTO OBJECT-TYPE

SYNTAX Integer32 (1..32)
UNITS "seconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION

"This object defines the maximum retransmission timeout interval which the tunnel will wait before retrans-

mitting a control packet that has not been acknowledged.
Modifications to this object have immediate effect."

```
DEFVAL { 16 }
::= { l2tpTunnelConfigEntry 10 }
```

l2tpTunnelConfigPayloadSeq OBJECT-TYPE

```
SYNTAX          INTEGER {
                    onDemand(1),
                    never(2),
                    always(3)
                }
```

```
MAX-ACCESS      read-write
```

```
STATUS          current
```

DESCRIPTION

"This object determines whether or not session payload packets will be requested to be sent with sequence numbers from tunnel peers belonging to this domain. The value onDemand(1) allows the L2TP implementation to initiate payload sequencing when necessary based on local information (e.g: during LCP/NCP negotiations or for CCP). The value never(2) indicates that L2TP will never initiate sequencing but will do sequencing if asked. The value always(3) indicates that L2TP will send the Sequencing Required AVP during session establishment. Modifications to this object have immediate effect."

```
DEFVAL { onDemand }
::= { l2tpTunnelConfigEntry 11 }
```

l2tpTunnelConfigReassemblyTO OBJECT-TYPE

```
SYNTAX          L2tpMilliseconds
```

```
MAX-ACCESS      read-write
```

```
STATUS          current
```

DESCRIPTION

"This object defines the number of milliseconds that this tunnel will wait before processing payload packets that were received out of sequence (which are waiting for the packet(s) to put them in sequence). A low value increases the chance of delayed packets to be discarded (which MAY cause the PPP decompression engine to reset) while a high value may cause more queuing and possibly degrade throughput if packets are truly lost. The default value for this object is zero which will result in all delayed packets being lost. Modifications to this object have immediate effect."

```
DEFVAL { 0 }
::= { l2tpTunnelConfigEntry 12 }
```

l2tpTunnelConfigTransport OBJECT-TYPE

```

SYNTAX          INTEGER {
                    other(1),
                    none(2),
                    udpIp(3),
                    frameRelay(4),
                    atm(5)
                  }

```

```

MAX-ACCESS      read-write

```

```

STATUS          current

```

DESCRIPTION

"This object defines the underlying transport media that is in use for this tunnel entry. Different tunnel transports may define MIB extensions to the L2TP tunnel table to realize the transport layer. For example if the value of this object is 'udpIp' then the value of ifIndex for this table may be used to determine state from the l2tpUdpStatsTable. This object cannot be modified when the tunnel is in a connecting or connected state."

```
 ::= { l2tpTunnelConfigEntry 13 }
```

l2tpTunnelConfigDrainTunnel OBJECT-TYPE

```

SYNTAX          TruthValue

```

```

MAX-ACCESS      read-write

```

```

STATUS          current

```

DESCRIPTION

"Setting this object to 'true' will prevent any new session from being either initiated or accepted but does NOT disconnect any active sessions for this tunnel. Note that when this occurs the l2tpTunnelStatsDrainingTunnel status object of this tunnel should reflect that it is 'draining'. To cancel a drain this object should be set to false(2). Setting this object to false(2) when the L2TP objects l2tpDrainTunnels or l2tpDomainConfigDrainTunnels is true(1) has no affect, this tunnels will continue to drain."

```

DEFVAL { false }

```

```
 ::= { l2tpTunnelConfigEntry 14 }
```

l2tpTunnelConfigProxyPPPAuth OBJECT-TYPE

```

SYNTAX          TruthValue

```

```

MAX-ACCESS      read-write

```

```

STATUS          current

```

DESCRIPTION

"This object is used to configure the sending or acceptance of the session PPP Proxy Authentication AVP's on the LAC or LNS."

```

DEFVAL { true }
 ::= { l2tpTunnelConfigEntry 15 }

```

```

--
-- The L2TP Tunnel Status and Statistics Table
--

```

```

l2tpTunnelStatsTable      OBJECT-TYPE
    SYNTAX                SEQUENCE OF L2tpTunnelStatsEntry
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "The L2TP tunnel status and statistics table. This
        table contains objects that can be used to describe
        the current status and statistics of a single L2TP
        tunnel. There is a 1-1 correspondence between
        conceptual rows of this table and conceptual rows of
        the l2tpTunnelConfigTable."
    ::= { l2tpObjects 5 }

```

```

l2tpTunnelStatsEntry      OBJECT-TYPE
    SYNTAX                L2tpTunnelStatsEntry
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "An L2TP tunnel interface stats entry."
    AUGMENTS { l2tpTunnelConfigEntry }
    ::= { l2tpTunnelStatsTable 1 }

```

```

L2tpTunnelStatsEntry ::=
    SEQUENCE {
        l2tpTunnelStatsLocalTID
            Integer32,
        l2tpTunnelStatsRemoteTID
            Integer32,
        l2tpTunnelStatsState
            INTEGER,
        l2tpTunnelStatsInitiated
            INTEGER,
        l2tpTunnelStatsRemoteHostName
            SnmpAdminString,
        l2tpTunnelStatsRemoteVendorName
            SnmpAdminString,
        l2tpTunnelStatsRemoteFirmwareRev
            Integer32,
        l2tpTunnelStatsRemoteProtocolVer
            OCTET STRING,

```

```

12tpTunnelStatsInitialRemoteRWS
    Integer32,
12tpTunnelStatsBearerCaps
    INTEGER,
12tpTunnelStatsFramingCaps
    INTEGER,
12tpTunnelStatsControlRxPkts
    Counter32,
12tpTunnelStatsControlRxZLB
    Counter32,
12tpTunnelStatsControlOutOfSeq
    Counter32,
12tpTunnelStatsControlOutOfWin
    Counter32,
12tpTunnelStatsControlTxPkts
    Counter32,
12tpTunnelStatsControlTxZLB
    Counter32,
12tpTunnelStatsControlAckTO
    Counter32,
12tpTunnelStatsCurrentRemoteRWS
    Gauge32,
12tpTunnelStatsTxSeq
    Integer32,
12tpTunnelStatsTxSeqAck
    Integer32,
12tpTunnelStatsRxSeq
    Integer32,
12tpTunnelStatsRxSeqAck
    Integer32,
12tpTunnelStatsTotalSessions
    Counter32,
12tpTunnelStatsFailedSessions
    Counter32,
12tpTunnelStatsActiveSessions
    Gauge32,
12tpTunnelStatsLastResultCode
    Integer32,
12tpTunnelStatsLastErrorCode
    Integer32,
12tpTunnelStatsLastErrorMessage
    SnmpAdminString,
12tpTunnelStatsDrainingTunnel
    TruthValue
}

```

```

12tpTunnelStatsLocalTID OBJECT-TYPE
    SYNTAX          Integer32 (0..65535)

```

```

MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the local tunnel Identifier."
REFERENCE "RFC 2661, Section 3.1"
::= { l2tpTunnelStatsEntry 1 }

```

```

l2tpTunnelStatsRemoteTID OBJECT-TYPE
    SYNTAX      Integer32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the remote tunnel Identifier."
    REFERENCE "RFC 2661, Section 3.1"
    ::= { l2tpTunnelStatsEntry 2 }

```

```

l2tpTunnelStatsState OBJECT-TYPE
    SYNTAX      INTEGER {
                    tunnelIdle(1),
                    tunnelConnecting(2),
                    tunnelEstablished(3),
                    tunnelDisconnecting(4)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This field contains the current state of the
         control tunnel."
    ::= { l2tpTunnelStatsEntry 3 }

```

```

l2tpTunnelStatsInitiated OBJECT-TYPE
    SYNTAX      INTEGER {
                    locally(1),
                    remotely(2)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object indicates whether the tunnel was
         initiated locally or by the remote tunnel peer."
    ::= { l2tpTunnelStatsEntry 4 }

```

```

l2tpTunnelStatsRemoteHostName OBJECT-TYPE
    SYNTAX      SnmpAdminString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the host name as discovered

```

during the tunnel establishment phase (via the Host Name AVP) of the L2TP peer. If the tunnel is idle this object should maintain its value from the last time it was connected."

::= { l2tpTunnelStatsEntry 5 }

l2tpTunnelStatsRemoteVendorName OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object identifies the vendor name of the peer's L2TP implementation. If the tunnel is idle this object should maintain its value from the last time it was connected."

::= { l2tpTunnelStatsEntry 6 }

l2tpTunnelStatsRemoteFirmwareRev OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the tunnel peer's firmware revision number. If the tunnel is idle this object should maintain its value from the last time it was connected."

::= { l2tpTunnelStatsEntry 7 }

l2tpTunnelStatsRemoteProtocolVer OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(2))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object describes the protocol version and revision of the tunnel peers implementation. The first octet contains the protocol version. The second octet contains the protocol revision."

::= { l2tpTunnelStatsEntry 8 }

l2tpTunnelStatsInitialRemoteRWS OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the initial remote peer's receive window size as indicated by the tunnel peer (in the RWS AVP) during the tunnel establishment phase. If the tunnel is idle this object should

maintain its value from the last time it was connected."
 ::= { l2tpTunnelStatsEntry 9 }

l2tpTunnelStatsBearerCaps OBJECT-TYPE

SYNTAX INTEGER {
 none(1),
 digital(2),
 analog(3),
 digitalAnalog(4)
 }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object describes the Bearer Capabilities of the tunnel peer. If the tunnel is idle this object should maintain its value from the last time it was connected."

::= { l2tpTunnelStatsEntry 10 }

l2tpTunnelStatsFramingCaps OBJECT-TYPE

SYNTAX INTEGER {
 none(1),
 sync(2),
 async(3),
 syncAsync(4)
 }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object describes the Framing Capabilities of the tunnel peer. If the tunnel is idle this object should maintain its value from the last time it was connected."

::= { l2tpTunnelStatsEntry 11 }

l2tpTunnelStatsControlRxPkts OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the number of control packets received on the tunnel."

::= { l2tpTunnelStatsEntry 12 }

l2tpTunnelStatsControlRxZLB OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current
DESCRIPTION
"This object returns a count of the number of Zero Length Body control packet acknowledgement packets that were received."
::= { l2tpTunnelStatsEntry 13 }

l2tpTunnelStatsControlOutOfSeq OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object returns a count of the number of control packets that were not received in the correct order (as per the sequence number) on this tunnel including out of window packets."
::= { l2tpTunnelStatsEntry 14 }

l2tpTunnelStatsControlOutOfWin OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the number of control packets that were received outside of the offered receive window. It is implementation specific as to whether these packets are queued or discarded."
::= { l2tpTunnelStatsEntry 15 }

l2tpTunnelStatsControlTxPkts OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the number of control packets that were transmitted to the tunnel peer."
::= { l2tpTunnelStatsEntry 16 }

l2tpTunnelStatsControlTxZLB OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the number of Zero Length Body control packets transmitted to the tunnel

```

        peer."
 ::= { l2tpTunnelStatsEntry 17 }

```

l2tpTunnelStatsControlAckTO OBJECT-TYPE

```

SYNTAX          Counter32
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object returns a count of the number of
    control packet timeouts due to the lack of a
    timely acknowledgement from the tunnel peer."
 ::= { l2tpTunnelStatsEntry 18 }

```

l2tpTunnelStatsCurrentRemoteRWS OBJECT-TYPE

```

SYNTAX          Gauge32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the current remote receive
    window size as determined by the local flow
    control mechanism employed."
 ::= { l2tpTunnelStatsEntry 19 }

```

l2tpTunnelStatsTxSeq OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the next send sequence number
    for the control channel."
 ::= { l2tpTunnelStatsEntry 20 }

```

l2tpTunnelStatsTxSeqAck OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the send sequence number that
    the tunnel peer has acknowledged for the control
    channel. The flow control state can be determined
    by subtracting the l2tpTunnelStatsTxSeq from
    l2tpTunnelStatsTxSeqAck and comparing this value
    to l2tpTunnelStatsCurrentRemoteRWS (taking into
    consideration sequence number wraps)."
 ::= { l2tpTunnelStatsEntry 21 }

```

l2tpTunnelStatsRxSeq OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)

```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the next receive sequence
number expected to be received on this control
channel."
::= { l2tpTunnelStatsEntry 22 }

l2tpTunnelStatsRxSeqAck OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the last receive sequence
number that was acknowledged back to the tunnel
peer for the control channel."
::= { l2tpTunnelStatsEntry 23 }

l2tpTunnelStatsTotalSessions OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the total number of sessions
that this tunnel has successfully connected through
to its tunnel peer since this tunnel was created."
::= { l2tpTunnelStatsEntry 24 }

l2tpTunnelStatsFailedSessions OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the total number of sessions
that were initiated but failed to reach the
established phase."
::= { l2tpTunnelStatsEntry 25 }

l2tpTunnelStatsActiveSessions OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains the total number of sessions
in the established state for this tunnel."
::= { l2tpTunnelStatsEntry 26 }

l2tpTunnelStatsLastResultCode OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the last value of the result
    code as described in the Result Code AVP which
    caused the tunnel to disconnect."
 ::= { l2tpTunnelStatsEntry 27 }

```

l2tpTunnelStatsLastErrorCode OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the last value of the error
    code as described in the Result Code AVP which
    caused the tunnel to disconnect."
 ::= { l2tpTunnelStatsEntry 28 }

```

l2tpTunnelStatsLastErrorMessage OBJECT-TYPE

```

SYNTAX          SnmpAdminString
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the last value of the optional
    message as described in the Result Code AVP which
    caused the tunnel to disconnect."
 ::= { l2tpTunnelStatsEntry 29 }

```

l2tpTunnelStatsDrainingTunnel OBJECT-TYPE

```

SYNTAX          TruthValue
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object indicates if this tunnel is draining
    off sessions. This object will return false(2) when
    the tunnel is not draining sessions or after the
    last session has disconnected when the tunnel is in
    the draining state."
 ::= { l2tpTunnelStatsEntry 30 }

```

```

--
-- { l2tpObjects 6 } reserved for future use
--

```

```

--
-- The L2TP Session Status and Statistics Table
--

```

```

l2tpSessionStatsTable    OBJECT-TYPE
    SYNTAX                SEQUENCE OF L2tpSessionStatsEntry
    MAX-ACCESS            not-accessible
    STATUS                current
    DESCRIPTION
        "The L2TP session status and statistics table. This
        table contains the objects that can be used to
        describe the current status and statistics of a
        single L2TP tunneled session."
    ::= { l2tpObjects 7 }

l2tpSessionStatsEntry    OBJECT-TYPE
    SYNTAX                L2tpSessionStatsEntry
    MAX-ACCESS            not-accessible
    STATUS                current
    DESCRIPTION
        "An L2TP session interface stats entry."
    INDEX { l2tpSessionStatsTunnelIfIndex,
            l2tpSessionStatsLocalSID }
    ::= { l2tpSessionStatsTable 1 }

L2tpSessionStatsEntry ::=
    SEQUENCE {
        l2tpSessionStatsTunnelIfIndex
            InterfaceIndex,
        l2tpSessionStatsIfIndex
            InterfaceIndex,
        l2tpSessionStatsLocalSID
            Integer32,
        l2tpSessionStatsRemoteSID
            Integer32,
        l2tpSessionStatsUserName
            SnmpAdminString,
        l2tpSessionStatsState
            INTEGER,
        l2tpSessionStatsCallType
            INTEGER,
        l2tpSessionStatsCallSerialNumber
            Unsigned32,
        l2tpSessionStatsTxConnectSpeed
            Unsigned32,
        l2tpSessionStatsRxConnectSpeed
            Unsigned32,
        l2tpSessionStatsCallBearerType
            INTEGER,
        l2tpSessionStatsFramingType
            INTEGER,
        l2tpSessionStatsPhysChanId

```

```

        Unsigned32,
12tpSessionStatsDNIS
        SnmpAdminString,
12tpSessionStatsCLID
        SnmpAdminString,
12tpSessionStatsSubAddress
        SnmpAdminString,
12tpSessionStatsPrivateGroupID
        SnmpAdminString,
12tpSessionStatsProxyLcp
        TruthValue,
12tpSessionStatsAuthMethod
        INTEGER,
12tpSessionStatsSequencingState
        INTEGER,
12tpSessionStatsOutSequence
        Counter32,
12tpSessionStatsReassemblyTO
        Counter32,
12tpSessionStatsTxSeq
        Integer32,
12tpSessionStatsRxSeq
        Integer32
    }

```

12tpSessionStatsTunnelIfIndex OBJECT-TYPE

```

SYNTAX          InterfaceIndex
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "This object identifies the session's associated
     L2TP tunnel ifIndex value."
 ::= { 12tpSessionStatsEntry 1 }

```

12tpSessionStatsIfIndex OBJECT-TYPE

```

SYNTAX          InterfaceIndex
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object identifies the ifIndex value of the
     interface from which PPP packets are being tunneled.
     For example this could be a DS0 ifIndex on a
     LAC or it would be the PPP ifIndex on the LNS."
 ::= { 12tpSessionStatsEntry 2 }

```

12tpSessionStatsLocalSID OBJECT-TYPE

```

SYNTAX          Integer32 (1..65535)
MAX-ACCESS      not-accessible

```

```

STATUS          current
DESCRIPTION
    "This object contains the local assigned session
    identifier for this session."
REFERENCE "RFC 2661, Section 3.1"
::= { l2tpSessionStatsEntry 3 }

```

```

l2tpSessionStatsRemoteSID OBJECT-TYPE
SYNTAX          Integer32  (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the remote assigned session
    identifier for this session. When a session is
    starting this value may be zero until the remote
    tunnel endpoint has responded."
REFERENCE "RFC 2661, Section 3.1"
::= { l2tpSessionStatsEntry 4 }

```

```

l2tpSessionStatsUserName OBJECT-TYPE
SYNTAX          SnmpAdminString
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object identifies the peer session name on
    this interface. This is typically the login name
    of the remote user. If the user name is unknown to
    the local tunnel peer then this object will contain
    a null string."
::= { l2tpSessionStatsEntry 5 }

```

```

l2tpSessionStatsState OBJECT-TYPE
SYNTAX          INTEGER {
                        sessionIdle(1),
                        sessionConnecting(2),
                        sessionEstablished(3),
                        sessionDisconnecting(4)
                    }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the current state of the
    session."
::= { l2tpSessionStatsEntry 6 }

```

```

l2tpSessionStatsCallType OBJECT-TYPE
SYNTAX          INTEGER {
                        lacIncoming(1),

```

```

                                lnsIncoming(2),
                                lacOutgoing(3),
                                lnsOutgoing(4)
                                }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object indicates the type of call and the
    role this tunnel peer is providing for this
    session. For example, lacIncoming(1) indicates
    that this tunnel peer is acting as a LAC and
    generated a Incoming-Call-Request to the tunnel
    peer (the LNS). Note that tunnel peers can be
    both LAC and LNS simultaneously."
 ::= { l2tpSessionStatsEntry 7 }

```

l2tpSessionStatsCallSerialNumber OBJECT-TYPE

```

SYNTAX          Unsigned32
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the serial number that has
    been assigned to this session."
 ::= { l2tpSessionStatsEntry 8 }

```

l2tpSessionStatsTxConnectSpeed OBJECT-TYPE

```

SYNTAX          Unsigned32
UNITS           "bits per second"
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object returns the last known transmit
    baud rate for this session."
 ::= { l2tpSessionStatsEntry 9 }

```

l2tpSessionStatsRxConnectSpeed OBJECT-TYPE

```

SYNTAX          Unsigned32
UNITS           "bits per second"
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object returns the last known receive
    baud rate for this session established."
 ::= { l2tpSessionStatsEntry 10 }

```

l2tpSessionStatsCallBearerType OBJECT-TYPE

```

SYNTAX          INTEGER {
                                none(1),

```

```

                                digital(2),
                                analog(3)
                                }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object describes the bearer type of this
    session."
 ::= { l2tpSessionStatsEntry 11 }

l2tpSessionStatsFramingType OBJECT-TYPE
SYNTAX          INTEGER {
                                none(1),
                                sync(2),
                                async(3)
                                }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object describes the framing type of this
    session."
 ::= { l2tpSessionStatsEntry 12 }

l2tpSessionStatsPhysChanId OBJECT-TYPE
SYNTAX          Unsigned32
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the physical channel
    identifier for the session."
 ::= { l2tpSessionStatsEntry 13 }

l2tpSessionStatsDNIS      OBJECT-TYPE
SYNTAX          SnmpAdminString
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object identifies the Dialed Number
    Information String that the LAC obtained from
    the network for the session. If no DNIS was
    provided then a null string will be returned."
 ::= { l2tpSessionStatsEntry 14 }

l2tpSessionStatsCLID      OBJECT-TYPE
SYNTAX          SnmpAdminString
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION

```

"This object identifies the Calling Line ID that the LAC obtained from the network for the session. If no CLID was provided then a null string will be returned."
 ::= { l2tpSessionStatsEntry 15 }

l2tpSessionStatsSubAddress OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object identifies the Sub Address that the LAC obtained from the network for the session. If no Sub Address was provided then a null string will be returned."
 ::= { l2tpSessionStatsEntry 16 }

l2tpSessionStatsPrivateGroupID OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object identifies the Private Group Identifier used for this tunneled session. If no Private Group Identifier was provided then a null string will be returned."
 ::= { l2tpSessionStatsEntry 17 }

l2tpSessionStatsProxyLcp OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates whether the LAC performed proxy LCP for this session."
 ::= { l2tpSessionStatsEntry 18 }

l2tpSessionStatsAuthMethod OBJECT-TYPE
SYNTAX INTEGER {
none(1),
text(2),
pppChap(3),
pppPap(4),
pppEap(5),
pppMsChapV1(6),
pppMsChapV2(7),
other(8)
}

```

MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object contains the proxy authentication
    method employed by the LAC for the session. If
    l2tpSessionProxyLcp is false(2) this object
    should not be interpreted."
 ::= { l2tpSessionStatsEntry 19 }

```

l2tpSessionStatsSequencingState OBJECT-TYPE

```

SYNTAX          INTEGER {
                    none(1),
                    remote(2),
                    local(3),
                    both(4)
                  }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object defines which tunnel peers have
    requested payload sequencing. The value of
    both(4) indicates that both peers have requested
    payload sequencing."
 ::= { l2tpSessionStatsEntry 20 }

```

l2tpSessionStatsOutSequence OBJECT-TYPE

```

SYNTAX          Counter32
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object returns the total number of packets
    received for this session which were received out
    of sequence."
 ::= { l2tpSessionStatsEntry 21 }

```

l2tpSessionStatsReassemblyTO OBJECT-TYPE

```

SYNTAX          Counter32
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object returns the number of reassembly
    timeouts that have occurred for this session."
 ::= { l2tpSessionStatsEntry 22 }

```

l2tpSessionStatsTxSeq OBJECT-TYPE

```

SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current

```

DESCRIPTION

"This object contains the next send sequence number for this session."

::= { l2tpSessionStatsEntry 23 }

l2tpSessionStatsRxSeq OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the next receive sequence number expected to be received on this session."

::= { l2tpSessionStatsEntry 24 }

--

-- The L2TP Tunnel Mapping Table

--

l2tpTunnelMapTable OBJECT-TYPE

SYNTAX SEQUENCE OF L2tpTunnelMapEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The L2TP Tunnel index mapping table. This table is intended to assist management applications to quickly determine what the ifIndex value is for a given local tunnel identifier."

::= { l2tpObjects 8 }

l2tpTunnelMapEntry OBJECT-TYPE

SYNTAX L2tpTunnelMapEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An L2TP tunnel index map entry."

INDEX { l2tpTunnelMapLocalTID }

::= { l2tpTunnelMapTable 1 }

L2tpTunnelMapEntry ::=

```
SEQUENCE {
    l2tpTunnelMapLocalTID
        Integer32,
    l2tpTunnelMapIfIndex
        InterfaceIndex
}
```

l2tpTunnelMapLocalTID OBJECT-TYPE

SYNTAX Integer32 (1..65535)

```

MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "This object contains the local tunnel Identifier."
REFERENCE "RFC 2661, Section 3.1"
::= { l2tpTunnelMapEntry 1 }

```

```

l2tpTunnelMapIfIndex OBJECT-TYPE
    SYNTAX          InterfaceIndex
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This value for this object is equal to the value
         of ifIndex of the Interfaces MIB for tunnel
         interfaces of type L2TP."
    ::= { l2tpTunnelMapEntry 2 }

```

```

--
-- The L2TP Session Mapping Table
--

```

```

l2tpSessionMapTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF L2tpSessionMapEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "The L2TP Session index mapping table. This table
         is intended to assist management applications
         to map interfaces to a tunnel and session
         identifier."
    ::= { l2tpObjects 9 }

```

```

l2tpSessionMapEntry OBJECT-TYPE
    SYNTAX          L2tpSessionMapEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An L2TP Session index map entry."
    INDEX { l2tpSessionMapIfIndex }
    ::= { l2tpSessionMapTable 1 }

```

```

L2tpSessionMapEntry ::=
    SEQUENCE {
        l2tpSessionMapIfIndex
            InterfaceIndex,
        l2tpSessionMapTunnelIfIndex
            InterfaceIndex,
        l2tpSessionMapLocalSID
    }

```

```

        Integer32,
        l2tpSessionMapStatus
        RowStatus
    }

l2tpSessionMapIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This object identifies the ifIndex value of the
        interface which is receiving or sending its packets
        over an L2TP tunnel. For example this could be a DS0
        ifIndex on a LAC or a PPP ifIndex on the LNS."
    ::= { l2tpSessionMapEntry 1 }

l2tpSessionMapTunnelIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "This object identifies the sessions associated
        L2TP tunnel ifIndex value. When this object is
        set it provides a binding between a particular
        interface identified by l2tpSessionMapIfIndex
        to a particular tunnel."
    ::= { l2tpSessionMapEntry 2 }

l2tpSessionMapLocalSID OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "This object contains the local assigned session
        identifier for this session."
    REFERENCE "RFC 2661, Section 3.1"
    ::= { l2tpSessionMapEntry 3 }

l2tpSessionMapStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The status of this session map entry."
    ::= { l2tpSessionMapEntry 4 }

--
--      { l2tpIpUdpObjects 1 } reserved for future use

```

```
--
--      The L2TP UDP/IP Transport Status and Statistics Table
--
```

```
l2tpUdpStatsTable      OBJECT-TYPE
    SYNTAX              SEQUENCE OF L2tpUdpStatsEntry
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION
        "The L2TP UDP/IP transport stats table. This table
        contains objects that can be used to describe the
        current status and statistics of the UDP/IP L2TP
        tunnel transport."
    ::= { l2tpIpUdpObjects 2 }
```

```
l2tpUdpStatsEntry      OBJECT-TYPE
    SYNTAX              L2tpUdpStatsEntry
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION
        "An L2TP UDP/IP transport stats entry."
    INDEX { l2tpUdpStatsIfIndex }
    ::= { l2tpUdpStatsTable 1 }
```

```
L2tpUdpStatsEntry ::=
    SEQUENCE {
        l2tpUdpStatsIfIndex
            InterfaceIndex,
        l2tpUdpStatsPeerPort
            Integer32,
        l2tpUdpStatsLocalPort
            Integer32
    }
```

```
l2tpUdpStatsIfIndex    OBJECT-TYPE
    SYNTAX              InterfaceIndex
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION
        "This value for this object is equal to the
        value of ifIndex of the Interfaces MIB for
        tunnel interfaces of type L2TP and which have
        a L2TP transport of UDP/IP."
    ::= { l2tpUdpStatsEntry 1 }
```

```
l2tpUdpStatsPeerPort   OBJECT-TYPE
    SYNTAX              Integer32 (0..65535)
    MAX-ACCESS          read-only
```

```

STATUS          current
DESCRIPTION
    "This object reflects the peer's UDP port number
    used for this tunnel. When not known a value of
    zero should be returned."
 ::= { l2tpUdpStatsEntry 2 }

l2tpUdpStatsLocalPort OBJECT-TYPE
SYNTAX          Integer32 (0..65535)
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "This object reflects the local UDP port number
    that this tunnel is bound to."
 ::= { l2tpUdpStatsEntry 3 }

--
--      Definition of generic L2TP notifications
--

l2tpTunnelAuthFailure NOTIFICATION-TYPE
OBJECTS          {
                  l2tpTunnelStatsInitiated,
                  l2tpTunnelStatsRemoteHostName
                  }
STATUS          current
DESCRIPTION
    "A l2tpTunnelAuthFailure trap signifies that an
    attempt to establish a tunnel to a remote peer
    has failed authentication."
 ::= { l2tpNotifications 1 }

--
--      conformance information
--

l2tpGroups      OBJECT IDENTIFIER ::= { l2tpConformance 1 }
l2tpCompliances OBJECT IDENTIFIER ::= { l2tpConformance 2 }

--
--      compliance statements
--

l2tpMIBFullCompliance MODULE-COMPLIANCE
STATUS          current
DESCRIPTION
    "When this MIB is implemented with support for
    read-create and read-write, then such an
```

implementation can claim full compliance. Such an implementation can then be both monitored and configured with this MIB."

```

MODULE          -- this module

-- unconditionally mandatory groups
MANDATORY-GROUPS {
    l2tpConfigGroup,
    l2tpStatsGroup,
    l2tpTrapGroup
}
-- conditionally mandatory groups
GROUP           l2tpIpUdpGroup
DESCRIPTION
    "This group is mandatory for implementations that
    support L2TP over UDP/IP."

-- optional groups
GROUP           l2tpDomainGroup
DESCRIPTION
    "This group is optional for L2TP devices that
    group tunnel endpoints into tunnel domains."

-- optional Mapping Group
GROUP           l2tpMappingGroup
DESCRIPTION
    "This group is optional for L2TP devices that
    provide index mapping."

-- optional Security Group
GROUP           l2tpSecurityGroup
DESCRIPTION
    "This group is optional for SNMP agents which support
    both authentication and privacy of SNMP messages for
    the management of L2TP keys."

-- optional High Capacity Group
GROUP           l2tpHCPacketGroup
DESCRIPTION
    "This group is mandatory for implementations that
    support the l2tpDomainGroup AND could potentially
    overflow the L2TP Domain 32-bit counters is less
    than one hour."

 ::= { l2tpCompliances 1 }

l2tpMIBReadOnlyCompliance MODULE-COMPLIANCE

```

```
STATUS          current
DESCRIPTION
    "When this MIB is implemented without support for
    read-create and read-write (i.e. in read-only mode),
    then such an implementation can claim read-only
    compliance. Such an implementation can then be
    monitored but can not be configured with this MIB."

MODULE          -- this module

-- unconditionally mandatory groups
MANDATORY-GROUPS {
    l2tpConfigGroup,
    l2tpStatsGroup,
    l2tpTrapGroup
}

OBJECT l2tpAdminState
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpDrainTunnels
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpTunnelConfigDomainId
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpTunnelConfigHelloInterval
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpTunnelConfigIdleTimeout
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpTunnelConfigControlRWS
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT l2tpTunnelConfigControlMaxRetx
```

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigControlMaxRetxTO

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigPayloadSeq

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigReassemblyTO

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigTransport

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigDrainTunnel

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpTunnelConfigProxyPPPAuth

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

-- conditionally mandatory groups

GROUP l2tpIpUdpGroup

DESCRIPTION

"This group is mandatory for implementations that support L2TP over UDP/IP."

-- optional groups

GROUP l2tpDomainGroup

DESCRIPTION

"This group is optional for L2TP devices that group tunnel endpoints into tunnel domains."

OBJECT l2tpDomainConfigAdminState

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigDrainTunnels

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigTunnelHelloInt

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigTunnelIdleTO

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigControlRWS

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigControlMaxRetx

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigControlMaxRetxTO

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigPayloadSeq

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigReassemblyTO

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigProxyPPPAuth

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT l2tpDomainConfigStorageType
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT l2tpDomainConfigStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

-- optional Mapping Group
GROUP l2tpMappingGroup
DESCRIPTION
"This group is optional for L2TP devices that
provide index mapping."

OBJECT l2tpSessionMapTunnelIfIndex
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT l2tpSessionMapStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

-- optional Security Group
GROUP l2tpSecurityGroup
DESCRIPTION
"This group is optional for SNMP agents which support
both authentication and privacy of SNMP messages for
the management of L2TP keys."

OBJECT l2tpDomainConfigAuth
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT l2tpDomainConfigSecret
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT l2tpDomainConfigTunnelSecurity
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT l2tpTunnelConfigAuth
 MIN-ACCESS read-only
 DESCRIPTION
 "Write access is not required."

OBJECT l2tpTunnelConfigSecret
 MIN-ACCESS read-only
 DESCRIPTION
 "Write access is not required."

OBJECT l2tpTunnelConfigSecurity
 MIN-ACCESS read-only
 DESCRIPTION
 "Write access is not required."

-- optional High Capacity Group
 GROUP l2tpHCPacketGroup
 DESCRIPTION
 "This group is mandatory for implementations that support the l2tpDomainGroup AND could potentially overflow the L2TP Domain 32-bit counters is less than one hour."

::= { l2tpCompliances 2 }

-- units of conformance

l2tpConfigGroup OBJECT-GROUP
 OBJECTS {
 l2tpAdminState,
 l2tpDrainTunnels,
 l2tpTunnelConfigDomainId,
 l2tpTunnelConfigHelloInterval,
 l2tpTunnelConfigIdleTimeout,
 l2tpTunnelConfigControlRWS,
 l2tpTunnelConfigControlMaxRetx,
 l2tpTunnelConfigControlMaxRetxTO,
 l2tpTunnelConfigPayloadSeq,
 l2tpTunnelConfigReassemblyTO,
 l2tpTunnelConfigTransport,
 l2tpTunnelConfigDrainTunnel,
 l2tpTunnelConfigProxyPPPAuth
 }
 STATUS current
 DESCRIPTION
 "A collection of objects providing configuration information of the L2TP protocol, tunnels and sessions."

```
::= { l2tpGroups 1 }
```

```
l2tpStatsGroup OBJECT-GROUP
```

```
OBJECTS {  
    l2tpProtocolVersions,  
    l2tpVendorName,  
    l2tpFirmwareRev,  
    l2tpDrainingTunnels,  
    l2tpTunnelStatsLocalTID,  
    l2tpTunnelStatsRemoteTID,  
    l2tpTunnelStatsState,  
    l2tpTunnelStatsInitiated,  
    l2tpTunnelStatsRemoteHostName,  
    l2tpTunnelStatsRemoteVendorName,  
    l2tpTunnelStatsRemoteFirmwareRev,  
    l2tpTunnelStatsRemoteProtocolVer,  
    l2tpTunnelStatsInitialRemoteRWS,  
    l2tpTunnelStatsBearerCaps,  
    l2tpTunnelStatsFramingCaps,  
    l2tpTunnelStatsControlRxPkts,  
    l2tpTunnelStatsControlRxZLB,  
    l2tpTunnelStatsControlOutOfSeq,  
    l2tpTunnelStatsControlOutOfWin,  
    l2tpTunnelStatsControlTxPkts,  
    l2tpTunnelStatsControlTxZLB,  
    l2tpTunnelStatsControlAckTO,  
    l2tpTunnelStatsCurrentRemoteRWS,  
    l2tpTunnelStatsTxSeq,  
    l2tpTunnelStatsTxSeqAck,  
    l2tpTunnelStatsRxSeq,  
    l2tpTunnelStatsRxSeqAck,  
    l2tpTunnelStatsTotalSessions,  
    l2tpTunnelStatsFailedSessions,  
    l2tpTunnelStatsActiveSessions,  
    l2tpTunnelStatsLastResultCode,  
    l2tpTunnelStatsLastErrorCode,  
    l2tpTunnelStatsLastErrorMessage,  
    l2tpTunnelStatsDrainingTunnel,  
    l2tpSessionStatsIfIndex,  
    l2tpSessionStatsRemoteSID,  
    l2tpSessionStatsUserName,  
    l2tpSessionStatsState,  
    l2tpSessionStatsCallType,  
    l2tpSessionStatsCallSerialNumber,  
    l2tpSessionStatsTxConnectSpeed,  
    l2tpSessionStatsRxConnectSpeed,  
    l2tpSessionStatsCallBearerType,  
    l2tpSessionStatsFramingType,  
}
```

```

    12tpSessionStatsPhysChanId,
    12tpSessionStatsDNIS,
    12tpSessionStatsCLID,
    12tpSessionStatsSubAddress,
    12tpSessionStatsPrivateGroupID,
    12tpSessionStatsProxyLcp,
    12tpSessionStatsAuthMethod,
    12tpSessionStatsSequencingState,
    12tpSessionStatsOutSequence,
    12tpSessionStatsReassemblyTO,
    12tpSessionStatsTxSeq,
    12tpSessionStatsRxSeq
  }
  STATUS          current
  DESCRIPTION
    "A collection of objects providing status and
    statistics of the L2TP protocol, tunnels and
    sessions."
  ::= { 12tpGroups 2 }

```

```

12tpIpUdpGroup OBJECT-GROUP
  OBJECTS {
    12tpUdpStatsPeerPort,
    12tpUdpStatsLocalPort
  }
  STATUS          current
  DESCRIPTION
    "A collection of objects providing status and
    statistics of the L2TP UDP/IP transport layer."
  ::= { 12tpGroups 3 }

```

```

12tpDomainGroup OBJECT-GROUP
  OBJECTS {
    12tpDomainConfigAdminState,
    12tpDomainConfigDrainTunnels,
    12tpDomainConfigTunnelHelloInt,
    12tpDomainConfigTunnelIdleTO,
    12tpDomainConfigControlRWS,
    12tpDomainConfigControlMaxRetx,
    12tpDomainConfigControlMaxRetxTO,
    12tpDomainConfigPayloadSeq,
    12tpDomainConfigReassemblyTO,
    12tpDomainConfigProxyPPPAAuth,
    12tpDomainConfigStorageType,
    12tpDomainConfigStatus,
    12tpDomainStatsTotalTunnels,
    12tpDomainStatsFailedTunnels,
    12tpDomainStatsFailedAuths,

```

```
        12tpDomainStatsActiveTunnels,
        12tpDomainStatsTotalSessions,
        12tpDomainStatsFailedSessions,
        12tpDomainStatsActiveSessions,
        12tpDomainStatsDrainingTunnels,
        12tpDomainStatsControlRxOctets,
        12tpDomainStatsControlRxPkts,
        12tpDomainStatsControlTxOctets,
        12tpDomainStatsControlTxPkts,
        12tpDomainStatsPayloadRxOctets,
        12tpDomainStatsPayloadRxPkts,
        12tpDomainStatsPayloadRxDiscs,
        12tpDomainStatsPayloadTxOctets,
        12tpDomainStatsPayloadTxPkts
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing configuration,
        status and statistics of L2TP tunnel domains."
    ::= { 12tpGroups 4 }

12tpMappingGroup OBJECT-GROUP
    OBJECTS {
        12tpTunnelMapIfIndex,
        12tpSessionMapTunnelIfIndex,
        12tpSessionMapLocalSID,
        12tpSessionMapStatus
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing index mapping."
    ::= { 12tpGroups 5 }

12tpSecurityGroup OBJECT-GROUP
    OBJECTS {
        12tpDomainConfigAuth,
        12tpDomainConfigSecret,
        12tpDomainConfigTunnelSecurity,
        12tpTunnelConfigAuth,
        12tpTunnelConfigSecret,
        12tpTunnelConfigSecurity
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing L2TP security
        configuration."
    ::= { 12tpGroups 6 }
```

```

12tpTrapGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        12tpTunnelAuthFailure
    }
    STATUS          current
    DESCRIPTION
        "A collection of L2TP trap events as specified
        in NOTIFICATION-TYPE constructs."
    ::= { 12tpGroups 7 }

12tpHCPacketGroup OBJECT-GROUP
    OBJECTS {
        12tpDomainStatsControlHCRxOctets,
        12tpDomainStatsControlHCRxPkts,
        12tpDomainStatsControlHCTxOctets,
        12tpDomainStatsControlHCTxPkts,
        12tpDomainStatsPayloadHCRxOctets,
        12tpDomainStatsPayloadHCRxPkts,
        12tpDomainStatsPayloadHCTxOctets,
        12tpDomainStatsPayloadHCTxPkts
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing High Capacity
        64-bit counter objects."
    ::= { 12tpGroups 8 }

END

```

5.0 Security Considerations

This MIB contains readable objects whose values provide information related to L2TP 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 [RFC2401]), 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.

If the agent allows configuring keys (for example the l2tpDomainConfigSecret object) via SNMP, for use by L2TP, then the security of L2TP is at best only as secure as SNMP. For this reason, all objects in the l2tpSecurityGroup MUST NOT be accessible via unencrypted messages. It is also recommended that keys not be made visible through SNMP GET (or GET-NEXT or GET-BULK) messages, even if encryption is used.

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 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] 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.

6.0 Acknowledgements

Many thanks to the L2TP working group members who provided valuable input into the content and structure of this MIB.

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Acknowledgement

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

