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:

- An overall architecture, described in RFC 2571 [RFC2571].
- 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].
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].

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].

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.

```
+--------------------------------------------+
|           Network Layer Protocol           |
|+-----------+-------------+--------+-------+
|           |             |        |
|         +-+--+          |        |    <=== PPP Multilink I/F
|         |MPPP|          |        |
|         ++--++          |        |
|          |  |           |        |
|       +--+  +--+        |        |
|       |        |        |        |
|     +-+-+    +-+-+    +-+-+    +-+-+    +-+-+  <=== PPP I/F
|     |PPP|    |PPP|    |PPP|    |PPP|  
|     +-+-+    +-+-+    +-+-+    +-+-+    +-+-+|
|       |        |        |        |
|  +----+--------+--------+--------+----+
|  |           L2TP Tunnel I/F          |
|  +------------------+-----------------+
|                     |
|            Ethernet          |
|+------------------------------+
```

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:

<table>
<thead>
<tr>
<th>ifIndex</th>
<th>ifType</th>
<th>Tunnel MIB tables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ethernetCsmacd(6)</td>
<td></td>
<td>Ethernet interface</td>
</tr>
<tr>
<td>2</td>
<td>tunnel(131)</td>
<td>tunnelIfTable</td>
<td>Tunnel interface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>l2tpTunnelConfigTable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>l2tpTunnelStatsTable</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ppp(23)</td>
<td></td>
<td>PPP interface #1</td>
</tr>
<tr>
<td>4</td>
<td>ppp(23)</td>
<td></td>
<td>PPP interface #2</td>
</tr>
<tr>
<td>5</td>
<td>ppp(23)</td>
<td></td>
<td>PPP interface #3</td>
</tr>
<tr>
<td>6</td>
<td>ppp(23)</td>
<td></td>
<td>PPP interface #4</td>
</tr>
<tr>
<td>7</td>
<td>mlppp(108)</td>
<td></td>
<td>MLPPP interface</td>
</tr>
</tbody>
</table>
The corresponding ifStack table entries would then be:

<table>
<thead>
<tr>
<th>HigherLayer</th>
<th>LowerLayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

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:

- ifPacketGroup OR
- ifHCPacketGroup OR
- 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:
    ‘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).
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.

```
+---------------------------------------+
|       L2TP Session Map Database       |
+---------------------------------------+
    +-----+-----------------+----------+
    |     |                 |
    +---+---+       +-----+------+
    |  ds0 |       | Tunnel I/F |
    +---+---+       +-----+------+
    |     |                 |
    +---+---+       +-----+------+
    |  ds1 |       |  Ethernet |
    +-------+       +------------+
```

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
  Postal: Occam Networks
  77 Robin Hill Road
  Santa Barbara, CA, 93117
  Tel:    +1 805692 2900
  Email:  evan@occamnetworks.com

  Pat R. Calhoun
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
l2tpDomainConfigDrainTunnels
l2tpDomainConfigAuth
l2tpDomainConfigSecret
SnmpAdminString,
l2tpDomainConfigTunnelSecurity
INTEGER,
l2tpDomainConfigTunnelHelloInt
Integer32,
l2tpDomainConfigTunnelIdleTO
Integer32,
l2tpDomainConfigControlRWS
Integer32,
l2tpDomainConfigControlMaxRetx
Integer32,
l2tpDomainConfigControlMaxRetxTO
Integer32,
l2tpDomainConfigPayloadSeq
INTEGER,
l2tpDomainConfigReassemblyTO
L2tpMilliSeconds,
l2tpDomainConfigProxyPPPAuth
TruthValue,
l2tpDomainConfigStorageType
StorageType,
l2tpDomainConfigStatus
RowStatus
}

l2tpDomainConfigId 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 l2tpDomainConfigId 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,
    l2tpDomainStatsPayloadHCRxPkts Counter64,
l2tpDomainStatsPayloadHCRxPkts
   Counter64,
l2tpDomainStatsPayloadHCRxDiscs
   Counter64,
l2tpDomainStatsPayloadHCTxOctets
   Counter64,
l2tpDomainStatsPayloadHCTxPkts
   Counter64
}

l2tpDomainStatsTotalTunnels 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."
 ::= { l2tpDomainStatsEntry 1 }

l2tpDomainStatsFailedTunnels OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "This object returns the number of tunnels that failed (e.g.: connection timeout, unsupported or malformed AVPs etc) to reach the established state for this tunnel domain."
 ::= { l2tpDomainStatsEntry 2 }

l2tpDomainStatsFailedAuths 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."
 ::= { l2tpDomainStatsEntry 3 }

l2tpDomainStatsActiveTunnels 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 (e.g., 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 }
l2tpDomainStatsPayloadRxDiscs 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."
::= { l2tpDomainStatsEntry 15 }

l2tpDomainStatsPayloadTxOctets 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."
::= { l2tpDomainStatsEntry 16 }

l2tpDomainStatsPayloadTxPkts 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."
::= { l2tpDomainStatsEntry 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.
--

l2tpDomainStatsControlHCRxOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object is a 64-bit version of l2tpDomainStatsControlRxOctets."
::= { l2tpDomainStatsEntry 18 }

l2tpDomainStatsControlHCRxPkts OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsControlRxPkts."
 ::= { 12tpDomainStatsEntry 19 }

l2tpDomainStatsControlHCTxOctets OBJECT-TYPE
SYNTAX           Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsControlTxOctets."
 ::= { 12tpDomainStatsEntry 20 }

l2tpDomainStatsControlHCTxPkts OBJECT-TYPE
SYNTAX           Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsControlTxPkts."
 ::= { 12tpDomainStatsEntry 21 }

l2tpDomainStatsPayloadHCRxOctets OBJECT-TYPE
SYNTAX           Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsPayloadRxOctets."
 ::= { 12tpDomainStatsEntry 22 }

l2tpDomainStatsPayloadHCRxPkts OBJECT-TYPE
SYNTAX           Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsPayloadRxPkts."
 ::= { 12tpDomainStatsEntry 23 }

l2tpDomainStatsPayloadHCRxDiscs OBJECT-TYPE
SYNTAX           Counter64
MAX-ACCESS       read-only
STATUS           current
DESCRIPTION      "This object is a 64-bit version of

  12tpDomainStatsPayloadRxDiscs."

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"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,
    l2tpTunnelConfigProxyPPPAuth   TruthValue
}

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

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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 }

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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."

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DEFVAL { true }
::= { 12tpTunnelConfigEntry 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,
l2tpTunnelStatsInitialRemoteRWS
   Integer32,
l2tpTunnelStatsBearerCaps
   INTEGER,
l2tpTunnelStatsFramingCaps
   INTEGER,
l2tpTunnelStatsControlRxPkts
   Counter32,
l2tpTunnelStatsControlRxZLB
   Counter32,
l2tpTunnelStatsControlOutOfSeq
   Counter32,
l2tpTunnelStatsControlOutOfWin
   Counter32,
l2tpTunnelStatsControlTxPkts
   Counter32,
l2tpTunnelStatsControlTxZLB
   Counter32,
l2tpTunnelStatsControlAckTO
   Counter32,
l2tpTunnelStatsCurrentRemoteRWS
   Gauge32,
l2tpTunnelStatsTxSeq
   Integer32,
l2tpTunnelStatsTxSeqAck
   Integer32,
l2tpTunnelStatsRxSeq
   Integer32,
l2tpTunnelStatsRxSeqAck
   Integer32,
l2tpTunnelStatsTotalSessions
   Counter32,
l2tpTunnelStatsFailedSessions
   Counter32,
l2tpTunnelStatsActiveSessions
   Gauge32,
l2tpTunnelStatsLastResultCode
   Integer32,
l2tpTunnelStatsLastErrorCode
   Integer32,
l2tpTunnelStatsLastErrorMessage
   SnmpAdminString,
l2tpTunnelStatsDrainingTunnel
   TruthValue

l2tpTunnelStatsLocalTID 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 }

12tpTunnelStatsRemoteVendorName 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 }

12tpTunnelStatsRemoteFirmwareRev 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 }

12tpTunnelStatsRemoteProtocolVer 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 peer’s implementation. The first octet contains the protocol version. The second octet contains the protocol revision."

::= { l2tpTunnelStatsEntry 8 }

12tpTunnelStatsInitialRemoteRWS 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
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 9 }

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 10 }

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 }

Caves, et. al. Standards Track [Page 41]
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
--

Caves, et. al. Standards Track [Page 44]
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,
   l2tpSessionStatsBearerType
      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."
::= { l2tpSessionStatsEntry 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."
::= { l2tpSessionStatsEntry 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
}
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
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,
  l2tpTunnelStatsControlRxBkts,
  l2tpTunnelStatsControlRxBLZB,
  l2tpTunnelStatsControlOutOfSeq,
  l2tpTunnelStatsControlOutOfWin,
  l2tpTunnelStatsControlTxPkts,
  l2tpTunnelStatsControlTxBLZB,
  l2tpTunnelStatsControlAckTO,
  l2tpTunnelStatsCurrentRemoteRWS,
  l2tpTunnelStatsTxSeq,
  l2tpTunnelStatsTxSeqAck,
  l2tpTunnelStatsTxSeq,
  l2tpTunnelStatsRxBktsAck,
  l2tpTunnelStatsTotalSessions,
  l2tpTunnelStatsFailedSessions,
  l2tpTunnelStatsActiveSessions,
  l2tpTunnelStatsLastResultCode,
  l2tpTunnelStatsLastErrorCode,
  l2tpTunnelStatsLastErrorMessage,
  l2tpTunnelStatsDrainingTunnel,
  l2tpSessionStatsIfIndex,
  l2tpSessionStatsRemoteSID,
  l2tpSessionStatsUserName,
  l2tpSessionStatsState,
  l2tpSessionStatsCallType,
  l2tpSessionStatsCallSerialNumber,
  l2tpSessionStatsTxConnectSpeed,
  l2tpSessionStatsRxConnectSpeed,
  l2tpSessionStatsCallBearerType,
  l2tpSessionStatsFramingType,
l2tpSessionStatsPhysChanId,
l2tpSessionStatsDNIS,
l2tpSessionStatsCLID,
l2tpSessionStatsSubAddress,
l2tpSessionStatsPrivateGroupID,
l2tpSessionStatsProxyLcp,
l2tpSessionStatsAuthMethod,
l2tpSessionStatsSequencingState,
l2tpSessionStatsOutSequence,
l2tpSessionStatsReassemblyTO,
l2tpSessionStatsTxSeq,
l2tpSessionStatsRxSeq

 STATUS          current
DESCRIPTION
"A collection of objects providing status and
statistics of the L2TP protocol, tunnels and
sessions."
::= { l2tpGroups 2 }

l2tpIpUdpGroup OBJECT-GROUP
OBJECTS {
  l2tpUdpStatsPeerPort,
  l2tpUdpStatsLocalPort
}
STATUS          current
DESCRIPTION
"A collection of objects providing status and
statistics of the L2TP UDP/IP transport layer."
::= { l2tpGroups 3 }

l2tpDomainGroup OBJECT-GROUP
OBJECTS {
  l2tpDomainConfigAdminState,
  l2tpDomainConfigDrainTunnels,
  l2tpDomainConfigTunnelHelloInt,
  l2tpDomainConfigTunnelIdleTO,
  l2tpDomainConfigControlRWS,
  l2tpDomainConfigControlMaxRetx,
  l2tpDomainConfigControlMaxRetxTO,
  l2tpDomainConfigPayloadSeq,
  l2tpDomainConfigReassemblyTO,
  l2tpDomainConfigProxyPPPAuth,
  l2tpDomainConfigStorageType,
  l2tpDomainConfigStatus,
  l2tpDomainStatsTotalTunnels,
  l2tpDomainStatsFailedTunnels,
  l2tpDomainStatsFailedAuths,
l2tpDomainStatsActiveTunnels,
l2tpDomainStatsTotalSessions,
l2tpDomainStatsFailedSessions,
l2tpDomainStatsActiveSessions,
l2tpDomainStatsDrainingTunnels,
l2tpDomainStatsControlRxOctets,
l2tpDomainStatsControlRxPkts,
l2tpDomainStatsControlTxOctets,
l2tpDomainStatsControlTxPkts,
l2tpDomainStatsPayloadRxOctets,
l2tpDomainStatsPayloadRxPkts,
l2tpDomainStatsPayloadRxDiscs,
l2tpDomainStatsPayloadTxOctets,
l2tpDomainStatsPayloadTxPkts

} STATUS current
DESCRIPTION
"A collection of objects providing configuration,
status and statistics of L2TP tunnel domains."
::= { l2tpGroups 4 }

l2tpMappingGroup OBJECT-GROUP
OBJECTS {
  l2tpTunnelMapIfIndex,
  l2tpSessionMapTunnelIfIndex,
  l2tpSessionMapLocalSID,
  l2tpSessionMapStatus
}
STATUS current
DESCRIPTION
"A collection of objects providing index mapping."
::= { l2tpGroups 5 }

l2tpSecurityGroup OBJECT-GROUP
OBJECTS {
  l2tpDomainConfigAuth,
  l2tpDomainConfigSecret,
  l2tpDomainConfigTunnelSecurity,
  l2tpTunnelConfigAuth,
  l2tpTunnelConfigSecret,
  l2tpTunnelConfigSecurity
}
STATUS current
DESCRIPTION
"A collection of objects providing L2TP security
configuration."
::= { l2tpGroups 6 }
l2tpTrapGroup NOTIFICATION-GROUP
NOTIFICATIONS {
  l2tpTunnelAuthFailure
}
STATUS current
DESCRIPTION
"A collection of L2TP trap events as specified in NOTIFICATION-TYPE constructs."
::= { l2tpGroups 7 }

l2tpHCPacketGroup OBJECT-GROUP
OBJECTS {
  l2tpDomainStatsControlHCRxOctets,
  l2tpDomainStatsControlHCRxPkts,
  l2tpDomainStatsControlHCTxOctets,
  l2tpDomainStatsControlHCTxPkts,
  l2tpDomainStatsPayloadHCRxOctets,
  l2tpDomainStatsPayloadHCRxPkts,
  l2tpDomainStatsPayloadHCTxOctets,
  l2tpDomainStatsPayloadHCTxPkts,
}
STATUS current
DESCRIPTION
"A collection of objects providing High Capacity 64-bit counter objects."
::= { l2tpGroups 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

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7.0 References


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