                   SNMP MIB Extension for X.25 LAPB

Status of this Memo

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

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 the Link Layer of
   X.25, LAPB. The objects defined here, along with the objects in the
   "SNMP MIB Extension for the Packet Layer of X.25" [9] and the
   "Definitions of Managed Objects for RS-232-like Hardware Devices"
   [8], combine to allow management of an X.25 protocol stack.

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1. The Network Management Framework

   The Internet-standard Network Management Framework consists of three
   components. These components give the rules for defining objects,
   the definitions of objects, and the protocol for manipulating
   objects.

   The network management framework structures objects in an abstract
   information tree. The branches of the tree name objects and the
   leaves of the tree contain the values manipulated to effect
   management. This tree is called the Management Information Base or
   MIB. The concepts of this tree are given in STD 16/RFC 1155 "The
   Structure of Management Information" or SMI [1]. The SMI defines the
   trunk of the tree and the types of objects used when defining the
   leaves. STD 16/RFC 1212, "Towards Concise MIB Definitions" [4],
   defines a more concise description mechanism that preserves all the
   principals of the SMI.

   The core MIB definitions for the Internet suite of protocols can be
   found in RFC 1156 [2] "Management Information Base for Network
   Management of TCP/IP-based internets". STD 17/RFC 1213 [5] defines
   MIB-II, an evolution of MIB-I with changes to incorporate
   implementation experience and new operational requirements.

   STD 15/RFC 1157 [3] defines the SNMP protocol itself. The protocol
   defines how to manipulate the objects in a remote MIB.

   The tree structure of the MIB allows new objects to be defined for
   the purpose of experimentation and evaluation.

2. Objects

   The definition of an object in the MIB requires an object name and
   type. Object names and types are defined using the subset of the
   Abstract Syntax Notation One (ASN.1) [6] defined in the SMI [1].
   Objects are named using ASN.1 object identifiers, administratively
   assigned names, to specify object types. The object name, together
   with an optional object instance, uniquely identifies a specific
   instance of an object. For human convenience, we often use a textual
   string, termed the OBJECT DESCRIPTOR, to also refer to objects.

   Objects also have a syntax that defines the abstract data structure
   corresponding to that object type. The ASN.1 language [6] provides

the primitives used for this purpose. The SMI [1] purposely
restricts the ASN.1 constructs which may be used for simplicity and
ease of implementation. The encoding of an object type simply
describes how to represent an object using ASN.1 encoding rules [7],
for purposes of dealing with the SNMP protocol.

2.1. Format of Definitions

   Section 4 contains the specification of all object types defined in
   this MIB module. The object definitions use the conventions given in
   the SMI [1] as amended by the concise MIB definitions [4].

3. Overview

3.1. Informal overview

   This section describes how the objects defined below relate with
   other MIBs. This section is only informational to help understand
   how the pieces fit together.

   The objects defined below are to be used in conjunction with MIB-II
   and other MIBs such as the X.25 packet level MIB [9]. A system with
   a complete X.25 stack running over a synchronous line will have at
   least two interfaces in the ifTable defined in MIB-II. There will be
   an interface for LAPB and another interface for the packet layer of
   X.25. There will also be objects defined in the RS-232-like MIB for
   the physical sync line.

   Each software interface identifies the layer below it used to send
   and receive packets. The X.25 MIB object, x25InfoDataLinkId,
   specifies an instance of lapbAdmnIndex for the LAPB interface under
   that X.25. The LAPB object, lapbOperPortId, defined below, identifies
   an instance of the rs232PortIndex for the the Sync line used by LAPB.

   For X.25 running over LAPB over Ethernet, the lapbAdmnPortId would
   identify the instance of ifIndex for the Ethernet interface.

   Each X.25 subnetwork will have separate entries in the ifTable. Thus
   a system with two X.25 lines would have two ifTable entries for the
   two X.25 packet layers and two other entries for the two LAPB
   interfaces. Each X.25 Packet Layer MIB would identify the instance of
   the LAPB MIB below it. Each LAPB MIB would identify the Sync line
   below it. The system would also have two entries for rs232PortTable
   and rs232SyncPortTable for the two physical lines.

   Since the ifTable as defined in MIB-II is device independent, it
   doesn't have anything specific for any type of interface. The
   objects below define the LAPB specific information for an interface

   of type LAPB. Different LAPB interfaces can also be differentiated by
   matching the values of ifIndex with lapbAdmnIndex.

3.2. Textual Conventions

   Two new data types are introduced as a textual conventions in this
   MIB document. These textual conventions enhance the readability of
   the specification and can ease comparison with other specifications
   if appropriate. It should be noted that the introduction of these
   textual conventions has no effect on either the syntax nor the
   semantics of any managed objects. The use of these is merely an
   artifact of the explanatory method used. Objects defined in terms of
   one of these methods are always encoded by means of the rules that
   define the primitive type. Hence, no changes to the SMI or the SNMP
   are necessary to accommodate these textual conventions which are
   adopted merely for the convenience of readers and writers in pursuit
   of the elusive goal of clear, concise, and unambiguous MIB documents.

   This MIB introduces the data types of:

                    PositiveInteger
                    ifIndexType

3.3. Formal overview

   Instances of the objects defined below represent attributes of a LAPB
   interface. LAPB interfaces are identified by an ifType object in the
   Internet-standard MIB [5] of

                lapb(16).

   For these interfaces, the value of the ifSpecific variable in the
   MIB-II [5] has the OBJECT IDENTIFIER value:

                lapb   OBJECT IDENTIFIER ::= { transmission 16 }

   The relationship between a LAPB interface and an interface in the
   context of the Internet-standard MIB [5] is one-to-one. As such, the
   value of an ifIndex object instance can be directly used to identify
   corresponding instances of the objects defined below.

   The objects defined below are defined in the context of ISO 7776 [10]
   and ISO 8885 [11]. Access to those documents maybe useful (but isn't
   essential) to understand the names and semantics of some objects.
   Where possible the object descriptions use the terminology of ISO
   7776; for example, one commonly used term refers to the peer LAPB as
   the DCE/remote DTE. This terminology does not restrict the
   instrumented LAPB to function only as a DTE. This MIB maybe applied

   to a LAPB configured as either a DCE or a DTE.

   To the extent that some attributes defined in the Internet standard
   MIB [5] are applicable to LAPB, those objects have not been
   duplicated here. In some instances some clarification of how to
   apply those objects to LAPB has been given.

   Some objects defined below include a DEFVAL clause. This clause
   provides reasonable (but not mandatory) default values to use when
   creating these objects. This does not imply this MIB defines any
   mechanism for creating or deleting LAPB interfaces. The creation and
   deletion of the objects of this MIB depend on the implementation
   method for creating and deleting LAPB interfaces. The DEFVAL clause
   provides reasonable defaults to allow further extension of the MIB to
   define methods for creating and deleting LAPB interfaces without
   having to deprecate these objects for the lack of a DEFVAL clause.

3.4. Tables

   This extension adds four tables to the MIB. These tables are:

                    lapbAdmnTable,
                    lapbOperTable,
                    lapbFlowTable, and
                    lapbXidTable.

   The lapbAdmnTable provides objects for common parameters used by LAPB
   such as the T1 retransmission timer or the N2 retransmission counter.
   Changes to objects in this table need not affect a running interface
   but provides access to the values used to initialize an interface.
   These values are read-write.

   The lapbOperTable provides objects to determine the parameters
   actually in use by an interface. These objects are read only. The
   values currently in use maybe different from the lapbAdmnTable values
   if the lapbAdmnTable was changed after interface initialization or if
   XID negotiation selected different values.

   The lapbFlowTable provides objects that report how the LAPB interface
   performs. These are read-only objects used to monitor operation.

   The lapbXidTable is not required for systems that do not transmit XID
   frames. For systems that do transmit XID frames, this table provides
   the values for the fields of the XID frame that are not already
   present in the lapbAdmnTable. The objects in this table are read-
   write.

3.5. Traps

   Since all LAPB interfaces have entries in the ifTable, significant
   changes in the state of the interface should send a linkUp or
   linkDown trap. Thus an interface that receives or sends a Frame
   Reject frame should send a linkDown trap. If the interface later
   comes back up, it should then send a linkUP trap.

4. Object Definitions

           RFC1381-MIB DEFINITIONS ::= BEGIN

           IMPORTS
                   Counter
                           FROM RFC1155-SMI
                   transmission
                           FROM RFC1213-MIB
                   OBJECT-TYPE
                           FROM RFC-1212;

                           -- LAPB MIB

           lapb   OBJECT IDENTIFIER ::= { transmission 16 }

           PositiveInteger ::= INTEGER (0..2147483647)

           IfIndexType   ::= INTEGER (1..2147483647)
           -- IfIndexType specifies an index object for a table
           -- with entries that match entries in the MIB-II ifTable.
           -- The value of the index for the table will match the
           -- ifIndex entry for same interface in the ifTable.
           -- The values of this object range from 1 to ifNumber
           -- inclusive.

           -- ##
           --   LAPB Admn Table
           -- ##

           -- Support of the lapbAdmnTable is mandatory for all
           -- agents of systems that implement LAPB.

           lapbAdmnTable   OBJECT-TYPE
                   SYNTAX SEQUENCE OF LapbAdmnEntry
                   ACCESS not-accessible
                   STATUS mandatory

                    DESCRIPTION
                            "This table contains objects that can be
                            changed to manage a LAPB interface.
                            Changing one of these parameters may take
                            effect in the operating LAPB immediately or
                            may wait until the interface is restarted
                            depending on the details of the
                            implementation.

                            Most of the objects in this read-write table
                            have corresponding read-only objects in the
                            lapbOperTable that return the current
                            operating value.

                            The operating values may be different from
                            these configured values if changed by XID
                            negotiation or if a configured parameter was
                            changed after the interface was started."
                    ::= { lapb 1 }

          lapbAdmnEntry   OBJECT-TYPE
                  SYNTAX LapbAdmnEntry
                  ACCESS not-accessible
                  STATUS mandatory
                  DESCRIPTION
                            "Configured parameter values for a specific
                            LAPB."
                  INDEX { lapbAdmnIndex }
                  ::= { lapbAdmnTable 1 }

          LapbAdmnEntry ::= SEQUENCE {
                  lapbAdmnIndex
                            IfIndexType,
                  lapbAdmnStationType
                            INTEGER,
                  lapbAdmnControlField
                            INTEGER,
                  lapbAdmnTransmitN1FrameSize
                            PositiveInteger,
                  lapbAdmnReceiveN1FrameSize
                            PositiveInteger,
                  lapbAdmnTransmitKWindowSize
                            INTEGER,
                  lapbAdmnReceiveKWindowSize
                            INTEGER,
                  lapbAdmnN2RxmitCount
                  INTEGER,
                  lapbAdmnT1AckTimer

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                            PositiveInteger,
                  lapbAdmnT2AckDelayTimer
                            PositiveInteger,
                  lapbAdmnT3DisconnectTimer
                            PositiveInteger,
                  lapbAdmnT4IdleTimer
                            PositiveInteger,
                  lapbAdmnActionInitiate
                            INTEGER,
                  lapbAdmnActionRecvDM
                            INTEGER
                  }

          lapbAdmnIndex    OBJECT-TYPE
                  SYNTAX  IfIndexType
                  ACCESS  read-only
                  STATUS  mandatory
                  DESCRIPTION
                          "The ifIndex value for the LAPB interface."
                  ::= { lapbAdmnEntry 1 }

          lapbAdmnStationType      OBJECT-TYPE
                  SYNTAX  INTEGER {
                          dte (1),
                          dce (2),
                          dxe (3)
                          }
                  ACCESS  read-write
                  STATUS  mandatory
                  DESCRIPTION
                          "Identifies the desired station type of this
                          interface."
                  REFERENCE "ISO 7776 section 3.1"
                  DEFVAL { dte }
                  ::= { lapbAdmnEntry 2 }

          lapbAdmnControlField OBJECT-TYPE
                  SYNTAX  INTEGER {
                          modulo8 (1),
                          modulo128 (2)
                          }
                  ACCESS  read-write
                  STATUS  mandatory
                  DESCRIPTION
                          "The desired size of the sequence numbers
                          used to number frames."
                  REFERENCE "ISO 8885 Table 3, Name: HDLC Option - 10"
                  DEFVAL { modulo8 }
```

                       ::= { lapbAdmnEntry 3 }

          lapbAdmnTransmitN1FrameSize OBJECT-TYPE
                  SYNTAX   PositiveInteger
                  ACCESS   read-write
                  STATUS   mandatory
                  DESCRIPTION
                          "The default maximum N1 frame size desired
                          in number of bits for a frame transmitted by
                          this DTE. This excludes flags and 0 bits
                          inserted for transparency."
                  REFERENCE "ISO 8885 Table 3,
                          Name: Information Field length"
                  DEFVAL { 36000 } -- 4500 * 8; 802.5 Frame size
                  ::= { lapbAdmnEntry 4 }

          lapbAdmnReceiveN1FrameSize OBJECT-TYPE
                  SYNTAX   PositiveInteger
                  ACCESS   read-write
                  STATUS   mandatory
                  DESCRIPTION
                          "The default maximum N1 frame size desired
                          in number of bits for a frame the DCE/remote
                          DTE transmits to this DTE. This excludes
                          flags and 0 bits inserted for transparency."
                  DEFVAL { 36000 } -- 4500 * 8; 802.5 Frame size
                  ::= { lapbAdmnEntry 5 }

          lapbAdmnTransmitKWindowSize OBJECT-TYPE
                  SYNTAX   INTEGER (1..127)
                  ACCESS   read-write
                  STATUS   mandatory
                  DESCRIPTION
                          "The default transmit window size for this
                          Interface. This is the maximum number of
                          unacknowledged sequenced PDUs that may be
                          outstanding from this DTE at any one time."
                  REFERENCE "ISO 8885 Table 3, Name: Window size"
                  DEFVAL { 7 }
                  ::= { lapbAdmnEntry 6 }

          lapbAdmnReceiveKWindowSize OBJECT-TYPE
                  SYNTAX   INTEGER (1..127)
                  ACCESS   read-write
                  STATUS   mandatory
                  DESCRIPTION
                          "The default receive window size for this
                          Interface. This is the maximum number of

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                    unacknowledged sequenced PDUs that may be
                    outstanding from the DCE/remote DTE at any
                    one time."
            REFERENCE "ISO 8885 Table 3, Name: Window size"
            DEFVAL { 7 }
            ::= { lapbAdmnEntry 7 }

    lapbAdmnN2RxmitCount    OBJECT-TYPE
            SYNTAX   INTEGER (0..65535)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                    "The default N2 retry counter for this
                    interface.  This specifies the number of
                    times a PDU will be resent after the T1
                    timer expires without an acknowledgement for
                    the PDU."
            REFERENCE "ISO 8885 Table 3,
                    Name: Retransmission Attempts"
            DEFVAL { 20 }
            ::= { lapbAdmnEntry 8 }

    lapbAdmnT1AckTimer      OBJECT-TYPE
            SYNTAX   PositiveInteger
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                    "The default T1 timer for this interface.
                    This specifies the maximum time in
                    Milliseconds to wait for acknowledgment of a
                    PDU."
            REFERENCE "ISO 8885 Table 3, Name:
                    Acknowledgement timer"
            DEFVAL { 3000 }
            ::= { lapbAdmnEntry 9 }

    lapbAdmnT2AckDelayTimer         OBJECT-TYPE
            SYNTAX   PositiveInteger
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                    "The default T2 timer for this interface.
                    This specifies the maximum time in
                    Milliseconds to wait before sending an
                    acknowledgment for a sequenced PDU.  A value
                    of zero means there will be no delay in
                    acknowledgement generation."
            REFERENCE "ISO 8885 Table 3,
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                           Name: Reply delay timer"
                  DEFVAL { 0 }
                  ::= { lapbAdmnEntry 10 }

          lapbAdmnT3DisconnectTimer OBJECT-TYPE
                  SYNTAX  PositiveInteger
                  ACCESS  read-write
                  STATUS  mandatory
                  DESCRIPTION
                          "The T3 timer for this interface.  This
                          specifies the time in Milliseconds to wait
                          before considering the link disconnected.  A
                          value of zero indicates the link will be
                          considered disconnected upon completion of
                          the frame exchange to disconnect the link."
                  REFERENCE "ISO 7776 section 5.7.1.3"
                  DEFVAL { 60000 }
                  ::= { lapbAdmnEntry 11 }

          lapbAdmnT4IdleTimer OBJECT-TYPE
                  SYNTAX  PositiveInteger
                  ACCESS  read-write
                  STATUS  mandatory
                  DESCRIPTION
                          "The T4 timer for this interface.  This
                          specifies the maximum time in Milliseconds
                          to allow without frames being exchanged on
                          the data link.  A value of 2147483647
                          indicates no idle timer is being kept."
                  REFERENCE "ISO 7776 section 5.7.1.4"
                  DEFVAL { 2147483647 }
                  ::= { lapbAdmnEntry 12 }

          lapbAdmnActionInitiate OBJECT-TYPE
                  SYNTAX  INTEGER {
                  sendSABM (1),
                          sendDISC (2),
                          sendDM (3),
                          none (4),
                          other (5)
                          }
                  ACCESS  read-write
                  STATUS  mandatory
                  DESCRIPTION
                          "This identifies the action LAPB will take
                          to initiate link set-up."
                  DEFVAL { sendSABM }
                  ::= { lapbAdmnEntry 13 }
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        lapbAdmnActionRecvDM OBJECT-TYPE
                SYNTAX  INTEGER {
                        sendSABM (1),
                        sendDISC (2),
                        other (3)
                        }
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                        "This identifies the action LAPB will take
                        when it receives a DM response."
                DEFVAL { sendSABM }
                ::= { lapbAdmnEntry 14 }


        -- ###########################################################
        --                    LAPB operating parameters.
        -- ###########################################################

        -- Support of the lapbOperTable is mandatory for all
        -- agents of systems that implement LAPB.

        lapbOperTable   OBJECT-TYPE
                SYNTAX  SEQUENCE OF LapbOperEntry
                ACCESS  not-accessible
                STATUS  mandatory
                DESCRIPTION
                        "This table contains configuration
                        information about interface parameters
                        currently set in the interface.  Many of
                        these objects have corresponding objects in
                the lapbAdmnTable."
                ::= { lapb 2 }

        lapbOperEntry   OBJECT-TYPE
                SYNTAX  LapbOperEntry
                ACCESS  not-accessible
                STATUS  mandatory
                DESCRIPTION
                        "Currently set parameter values for a
                        specific LAPB."
                INDEX { lapbOperIndex }
                ::= { lapbOperTable 1 }

        LapbOperEntry ::= SEQUENCE {
                lapbOperIndex
                        IfIndexType,
                lapbOperStationType
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                         INTEGER,
                lapbOperControlField
                         INTEGER,
                lapbOperTransmitN1FrameSize
                         PositiveInteger,
                lapbOperReceiveN1FrameSize
                         PositiveInteger,
                lapbOperTransmitKWindowSize
                         INTEGER,
                lapbOperReceiveKWindowSize
                         INTEGER,
                lapbOperN2RxmitCount
                         INTEGER,
                lapbOperT1AckTimer
                         PositiveInteger,
                lapbOperT2AckDelayTimer
                         PositiveInteger,
                lapbOperT3DisconnectTimer
                         PositiveInteger,
                lapbOperT4IdleTimer
                         PositiveInteger,
                lapbOperPortId
                         OBJECT IDENTIFIER,
                lapbOperProtocolVersionId
                         OBJECT IDENTIFIER
                }

        lapbOperIndex   OBJECT-TYPE
           SYNTAX       IfIndexType
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The ifIndex value for the LAPB interface."
                ::= { lapbOperEntry 1 }

        lapbOperStationType     OBJECT-TYPE
                SYNTAX  INTEGER {
                        dte (1),
                        dce (2),
                        dxe (3)
                        }
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "Identifies the current operating station
                        type of this interface.  A value of dxe (3)
                        indicates XID negotiation has not yet taken
                        place."
```

```
                    REFERENCE "ISO 7776 section 3.1"
                    ::= { lapbOperEntry 2 }

        lapbOperControlField OBJECT-TYPE
                SYNTAX  INTEGER {
                        modulo8 (1),
                        modulo128 (2)
                        }
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The current operating size of the sequence
                        numbers used to number frames."
                REFERENCE "ISO 7776 section 3.3"
                ::= { lapbOperEntry 3 }

        lapbOperTransmitN1FrameSize OBJECT-TYPE
                SYNTAX  PositiveInteger
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The current operating N1 frame size used
                        for the maximum number of bits in a frame
                        this DTE can transmit.  This excludes flags
                        and 0 bits inserted for transparency."
                REFERENCE "ISO 7776 section 5.7.3"
                ::= { lapbOperEntry 4 }

        lapbOperReceiveN1FrameSize OBJECT-TYPE
                SYNTAX  PositiveInteger
                ACCESS  read-only
                STATUS  mandatory
                -- See lapbOperTransmitN1FrameSize above
                DESCRIPTION
                        "The current operating N1 frame size used
                        for the maximum number of bits in a frame
                        the DCE/remote DTE can transmit.  This
                        excludes flags and 0 bits inserted for
                        transparency."
                ::= { lapbOperEntry 5 }

        lapbOperTransmitKWindowSize OBJECT-TYPE
                SYNTAX  INTEGER (1..127)
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The current PDU window size this Interface
                        uses to transmit.  This is the maximum
```

                         number of unacknowledged sequenced PDUs that
                         may be outstanding from this DTE at any one
                         time."
                REFERENCE "ISO 7776 section 5.7.4"
                ::= { lapbOperEntry 6 }

        lapbOperReceiveKWindowSize OBJECT-TYPE
                SYNTAX INTEGER (1..127)
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                        "The current receive PDU window size for
                         this Interface. This is the maximum number
                         of unacknowledged sequenced PDUs that may be
                         outstanding from the DCE/remote DTE at any
                         one time."
                REFERENCE "ISO 7776 section 5.7.4"
                ::= { lapbOperEntry 7 }

        lapbOperN2RxmitCount   OBJECT-TYPE
                SYNTAX INTEGER (0..65535)
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                        "The current N2 retry counter used for this
                         interface. This specifies the number of
                         times a PDU will be resent after the T1
                         timer expires without an acknowledgement for
                         the PDU."
                REFERENCE "ISO 7776 section 5.7.2"
                ::= { lapbOperEntry 8 }

        lapbOperT1AckTimer   OBJECT-TYPE
                SYNTAX PositiveInteger
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                        "The current T1 timer for this interface.
                         This specifies the maximum time in
                         Milliseconds to wait for acknowledgment of a
                         PDU."
                REFERENCE "ISO 7776 section 5.7.1.1"
                ::= { lapbOperEntry 9 }

        lapbOperT2AckDelayTimer   OBJECT-TYPE
                SYNTAX PositiveInteger
                ACCESS read-only
                STATUS mandatory

```
               DESCRIPTION
                       "The current T2 timer for this interface.
                       This specifies the maximum time in
                       Milliseconds to wait before sending an
                       acknowledgment for a sequenced PDU.  A value
                       of zero means there will be no delay in
                       acknowledgement generation."
               REFERENCE "ISO 7776 section 5.7.1.2"
               ::= { lapbOperEntry 10 }

       lapbOperT3DisconnectTimer OBJECT-TYPE
               SYNTAX  PositiveInteger
               ACCESS  read-only
               STATUS  mandatory
               DESCRIPTION
                       "The current T3 timer for this interface.
                       This specifies the time in Milliseconds to
                       wait before considering the link
                       disconnected.  A value of zero indicates the
                       link will be considered disconnected upon
                       completion of the frame exchange to
                       disconnect the link."
               REFERENCE "ISO 7776 section 5.7.1.3"
               ::= { lapbOperEntry 11 }

       lapbOperT4IdleTimer OBJECT-TYPE
               SYNTAX  PositiveInteger
               ACCESS  read-write
               STATUS  mandatory
               DESCRIPTION
                       "The current T4 timer for this interface.
                       This specifies the maximum time in
                       Milliseconds to allow without frames being
                       exchanged on the data link.  A value of
                       2147483647 indicates no idle timer is being
                       kept."
               REFERENCE "ISO 7776 section 5.7.1.4"
               ::= { lapbOperEntry 12 }

       lapbOperPortId OBJECT-TYPE
               SYNTAX  OBJECT IDENTIFIER
               ACCESS  read-only
               STATUS  mandatory
               DESCRIPTION
                       "This object identifies an instance of the
                       index object in the first group of objects
                       in the MIB specific to the physical device
                       or interface used to send and receive
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```
                              frames.  If an agent does not support any
                              such objects, it should return nullSpec
                              OBJECT IDENTIFIER {0 0}."
                      ::= { lapbOperEntry 13 }

            lapbOperProtocolVersionId        OBJECT-TYPE
                      SYNTAX   OBJECT IDENTIFIER
                      ACCESS   read-only
                      STATUS   mandatory
                      DESCRIPTION
                              "This object identifies the version of the
                              lapb protocol implemented by this
                              interface."
                      ::= { lapbOperEntry 14 }


            -- ###########################################################
            --                      LAPB    Flow Table
            -- ###########################################################

            -- Support of the lapbFlowTable is mandatory for all
            -- agents of systems that implement LAPB.

            lapbFlowTable OBJECT-TYPE
                      SYNTAX   SEQUENCE OF LapbFlowEntry
                      ACCESS   not-accessible
                      STATUS   mandatory
                      DESCRIPTION
                              "This table defines the objects recorded by
                              LAPB to provide information about the
                              traffic flow through the interface."
                      ::= { lapb 3 }

            lapbFlowEntry OBJECT-TYPE
                      SYNTAX   LapbFlowEntry
                      ACCESS   not-accessible
                      STATUS   mandatory
                      DESCRIPTION
                              "The information regarding the effects of
                              flow controls in LAPB."
                       INDEX { lapbFlowIfIndex }
                      ::= { lapbFlowTable 1 }

            LapbFlowEntry ::= SEQUENCE {
                      lapbFlowIfIndex
                              IfIndexType,
                      lapbFlowStateChanges
                              Counter,
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```
             lapbFlowChangeReason
                     INTEGER,
             lapbFlowCurrentMode
                     INTEGER,
             lapbFlowBusyDefers
                     Counter,
             lapbFlowRejOutPkts
                     Counter,
             lapbFlowRejInPkts
                     Counter,
             lapbFlowT1Timeouts
                     Counter,
             lapbFlowFrmrSent
             OCTET STRING,
             lapbFlowFrmrReceived
                     OCTET STRING,
             lapbFlowXidReceived
                     OCTET STRING
             }

     lapbFlowIfIndex OBJECT-TYPE
             SYNTAX  IfIndexType
             ACCESS  read-only
             STATUS  mandatory
             DESCRIPTION
                     "The ifIndex value for the LAPB Interface."
             ::= { lapbFlowEntry 1 }

     lapbFlowStateChanges OBJECT-TYPE
             SYNTAX  Counter
             ACCESS  read-only
             STATUS  mandatory
             DESCRIPTION
                     "The number of LAPB State Changes, including
                     resets."
             ::= { lapbFlowEntry 2 }

     lapbFlowChangeReason OBJECT-TYPE
             SYNTAX  INTEGER {
                     notStarted (1),    -- Initial state
                     abmEntered (2),    -- SABM or UA
                     abmeEntered (3),   -- SABME or UA
                     abmReset (4),      -- SABM in ABM
                     abmeReset (5),     -- SABME in ABME
                     dmReceived (6),    -- DM Response
                     dmSent (7),        -- DM sent
                     discReceived (8),  -- DISC Response
                     discSent (9),      -- DISC Sent
```

```
                          frmrReceived (10), -- FRMR Received
                          frmrSent (11),     -- FRMR Sent
                          n2Timeout (12),    -- N2 Timer Expired
                          other (13)
                            }
                 ACCESS  read-only
                 STATUS  mandatory
                 DESCRIPTION
                         "The reason for the most recent incrementing
                         of lapbFlowStateChanges.  A DM or DISC frame
                         generated to initiate link set-up does not
                         alter this object.  When the MIB-II object
                         ifOperStatus does not have a value of
                         testing, there exists a correlation between
                         this object and ifOperStatus.  IfOperStatus
                         will have a value of up when this object
                         contains:  abmEntered, abmeEntered,
                         abmReset, or abmeReset.  IfOperStatus will
                         have a value of down when this object has a
                         value of notStarted, or dmReceived through
                         n2Timeout.  There is no correlation when
                         this object has the value other."
                 ::= { lapbFlowEntry 3 }

         lapbFlowCurrentMode OBJECT-TYPE
                 SYNTAX  INTEGER {
                         disconnected (1),
                                 -- initial state or DISC received

                         linkSetup (2),
                                 -- SABM sent

                         frameReject (3),
                                 -- Invalid frame received and
                                 -- FRMR sent

                         disconnectRequest (4),
                                 -- DISC sent

                         informationTransfer (5),
                                 -- normal information transfer state
                                 -- SABM(E) sent and UA received, or
                                 -- SABM(E) received and UA sent

                         rejFrameSent (6),
                                 -- invalid NS received and REJ sent

                         waitingAcknowledgement (7),
```

```
                               -- T1 expired and RR sent

                    stationBusy (8),
                            -- RNR sent

                    remoteStationBusy (9),
                            -- RNR received

                    bothStationsBusy (10),
                            -- RNR received and RNR sent

                    waitingAckStationBusy (11),
                            -- T1 expired, RNR sent

                    waitingAckRemoteBusy (12),
                            -- T1 expired, RNR received

                    waitingAckBothBusy (13),
                            -- T1 expired, RNR sent,
                            -- and RNR received

                    rejFrameSentRemoteBusy (14),
                            -- REJ sent and RNR received

                    xidFrameSent (15),
                            -- XID frame sent

                    error (16),
                            -- An error state other than
                            -- a one defined above

                    other (17)
                            --  A state not listed above
                      }
              ACCESS  read-only
              STATUS  mandatory
              DESCRIPTION
                    "The current condition of the conversation."
              ::= { lapbFlowEntry 4 }

       lapbFlowBusyDefers OBJECT-TYPE
              SYNTAX  Counter
              ACCESS  read-only
              STATUS  mandatory
              DESCRIPTION
                    "The number of times this device was unable
                    to transmit a frame due to a perceived
                    remote busy condition.  Busy conditions can
```

                        result from the receipt of an RNR from the
                        remote device, the lack of valid sequence
                        number space (window saturation), or other
                        conditions."
                ::= { lapbFlowEntry 5 }

        lapbFlowRejOutPkts OBJECT-TYPE
                SYNTAX   Counter
                ACCESS   read-only
                STATUS   mandatory
                DESCRIPTION
                        "The number of REJ or SREJ frames sent by
                        this station."
                ::= { lapbFlowEntry 6 }

        lapbFlowRejInPkts OBJECT-TYPE
                SYNTAX   Counter
                ACCESS   read-only
                STATUS   mandatory
                DESCRIPTION
                        "The number of REJ or SREJ frames received
                        by this station."
                ::= { lapbFlowEntry 7 }

        lapbFlowT1Timeouts OBJECT-TYPE
                SYNTAX   Counter
                ACCESS   read-only
                STATUS   mandatory
                DESCRIPTION
                        "The number of times a re-transmission was
                        effected by the T1 Timer expiring."
                ::= { lapbFlowEntry 8 }

        lapbFlowFrmrSent OBJECT-TYPE
                SYNTAX   OCTET STRING (SIZE (0..7))
                ACCESS   read-only
                STATUS   mandatory
                DESCRIPTION
                        "The Information Field of the FRMR most
                        recently sent. If no FRMR has been sent
                        (the normal case) or the information isn't
                        available, this will be an OCTET STRING of
                        zero length."
                REFERENCE "ISO 7776 Section 4.3.9, tables 7 and 8"
                ::= { lapbFlowEntry 9 }

        lapbFlowFrmrReceived OBJECT-TYPE
                SYNTAX   OCTET STRING (SIZE (0..7))

```
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The Information Field of the FRMR most
                        recently received.  If no FRMR has been
                        received (the normal case) or the
                        information isn't available, this will be an
                        OCTET STRING of zero length."
                REFERENCE "ISO 7776 Section 4.3.9, tables 7 and 8"
                ::= { lapbFlowEntry 10 }

        lapbFlowXidReceived OBJECT-TYPE
                SYNTAX  OCTET STRING (SIZE (0..8206))
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                        "The Information Field of the XID frame most
                        recently received.  If no XID frame has been
                        received, this will be an OCTET STRING of
                        zero length."
                REFERENCE "ISO 8885"
                ::= { lapbFlowEntry 11 }


        -- ###########################################################
        --                    LAPB    XID Table
        -- ###########################################################

        -- Support for the lapbXidTable is mandatory for all agents
        -- of systems that have a LAPB implementation using XID
        -- negotiation.  Agents of systems without XID negotiation
        -- support should not implement this table.

        lapbXidTable    OBJECT-TYPE
                SYNTAX  SEQUENCE OF LapbXidEntry
                ACCESS  not-accessible
                STATUS  mandatory
                DESCRIPTION
                        "This table defines values to use for XID
                        negotiation that are not found in the
                        lapbAdmnTable.  This table is optional for
                        implementations that don't support XID and
                        mandatory for implementations that do
                        initiate XID negotiation."
                ::= { lapb 4 }

        lapbXidEntry    OBJECT-TYPE
                SYNTAX  LapbXidEntry
```

```
        ACCESS      not-accessible
            STATUS  mandatory
            DESCRIPTION
                    "XId negotiation parameter values for a
                    specific LAPB."
            INDEX { lapbXidIndex }
            ::= { lapbXidTable 1 }


    LapbXidEntry ::= SEQUENCE {
            lapbXidIndex
                    IfIndexType,
            lapbXidAdRIdentifier
                    OCTET STRING,
            lapbXidAdRAddress
                    OCTET STRING,
            lapbXidParameterUniqueIdentifier
                    OCTET STRING,
            lapbXidGroupAddress
                    OCTET STRING,
            lapbXidPortNumber
                    OCTET STRING,
            lapbXidUserDataSubfield
                    OCTET STRING
            }

    lapbXidIndex    OBJECT-TYPE
            SYNTAX  IfIndexType
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The ifIndex value for the LAPB interface."
            ::= { lapbXidEntry 1 }

    lapbXidAdRIdentifier OBJECT-TYPE
            SYNTAX  OCTET STRING (SIZE (0..255))
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The value of the Address Resolution
                    Identifier.  A zero length string indicates
                    no Identifier value has been assigned."
            REFERENCE "ISO 8885 Table 2, Name: Identifier"
            DEFVAL { ''h }
            ::= { lapbXidEntry 2 }

    lapbXidAdRAddress OBJECT-TYPE
            SYNTAX  OCTET STRING (SIZE (0..255))
```

```
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                        "The value of the Address Resolution
                        Address.  A zero length string indicates no
                        Address value has been assigned."
                REFERENCE "ISO 8885 Table 2, Name: Address"
                DEFVAL { ''h }
                ::= { lapbXidEntry 3 }

        lapbXidParameterUniqueIdentifier OBJECT-TYPE
                SYNTAX  OCTET STRING (SIZE (0..255))
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                        "The value of the parameter unique
                        Identifier.  A zero length string indicates
                        no Unique identifier value has been
                        assigned."
                REFERENCE "ISO 8885 Table 3, Name: Identifier"
                DEFVAL { ''h }
                ::= { lapbXidEntry 4 }

        lapbXidGroupAddress OBJECT-TYPE
                SYNTAX  OCTET STRING (SIZE (0..255))
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                        "The value of the parameter Group address.
                        A zero length string indicates no Group
                        address value has been assigned."
                REFERENCE "ISO 8885 Table 3, Name: Group address"
                DEFVAL { ''h }
                ::= { lapbXidEntry 5 }

        lapbXidPortNumber OBJECT-TYPE
                SYNTAX  OCTET STRING (SIZE (0..255))
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                        "The port number assigned for this link.  A
                        zero length string indicates no local port
                        number identifier has been assigned."
                REFERENCE "ISO 8885 Table 3, Name: Port number"
                DEFVAL { ''h }
                ::= { lapbXidEntry 6 }

        lapbXidUserDataSubfield OBJECT-TYPE
```

```
                     SYNTAX  OCTET STRING (SIZE (0..8206))
                     ACCESS  read-write
                     STATUS  mandatory
                     DESCRIPTION
                             "A user data subfield, if any, to be
                             transmitted in an XID frame.  A zero length
                             frame indicates no user data subfield has
                             been assigned.  The octet string should
                             include both the User data identifier and
                             User data field as shown in Figures 1 and
                             4."
                     REFERENCE "ISO 8885 section 4.3"
                     DEFVAL { ''h }
                     ::= { lapbXidEntry 7 }


        -- ############################################################
        --                    LAPB protocol versions
        -- ############################################################

        lapbProtocolVersion OBJECT IDENTIFIER
                ::= { lapb 5 }

        lapbProtocolIso7776v1986 OBJECT IDENTIFIER
                ::= { lapbProtocolVersion 1 }

        lapbProtocolCcittV1980 OBJECT IDENTIFIER
                ::= { lapbProtocolVersion 2 }

        lapbProtocolCcittV1984 OBJECT IDENTIFIER
                ::= { lapbProtocolVersion 3 }



        -- The following describes some of the MIB-II interface
        -- objects and their relationship with the objects in this
        -- MIB extension.

        -- ifDescr:  describes the interface.   It should include
        -- identification information for the physical line and a
        -- description of the network.  For connections to PDNs,
        -- it should name the PDN.

        -- ifMtu: the maximum number of octets an upper layer can
        -- pass to this interface as a single frame.

        -- ifSpeed:
```

```
       -- ifAdminStatus:

       -- ifOperStatus:

       -- ifLastChange: the last time the state of the interface
       -- changed.  A reset is considered an instantaneous change to
       -- the ndm state and back to abm or abme.  This will be the
       -- last time that lapbFlowChangeReason and lapbFlowChanges
       -- changed.

       -- ifInOctets: contains the number of octets
       -- received from the peer LAPB including FCS.

       -- ifInUcastPkts: contains the number of I-frames delivered
       -- by this interface to a higher layer interface.

       -- ifInDiscards: contains the number of received
       -- frames discarded because of internal conditions
       -- (such as lack of buffering).

       -- ifInErrors: contains the number of Invalid frames received.
       -- This does not have any relationship with the number REJ,
       -- or RNR frames sent or received.

       -- ifInUnknownProtos: contains the number of frames
       -- that were correct but were dropped because they
       -- were inappropriate for the current state.  This
       -- includes an invalid Poll bit, an unknown address,
       -- or other condition such as an RNR when connection
       -- not established.  This also includes the number of
       -- DISC or other frames that were ignored because the
       -- link was not established and this interface was not
       -- configured to perform link setup on that type frame.

       -- ifOutOctets: number of octets sent to peer including
       -- FCS octets.

       -- ifOutUcastPkts: number of I-frames received from
       -- a higher layer for transmission to peer.

       -- ifOutDiscards: number of frames to be sent that were
       -- dropped due to internal conditions such as buffering etc.

       -- ifOutErrors: number of transmissions that failed
       -- due to errors or were considered invalid by the receiver.
       -- This does not have any relationship with the number REJ,
       -- or RNR frames sent or received.
```

```
        -- ifOutQLen: number of frames waiting to be transmitted.


        -- This MIB does not provide any support for:
        --      Multilink procedure (MLP) in ISO 7776 section 6
        --      LLC Pbit timer
        --      LLC REJ timer
        --      LLC Busy State Timer 7.8.1.4

        -- ##########################################################

        END
```

5. Appendix: Revision History

July 30, 1992

The July revision of this document (Editor's Internal Reference 2.10)
incorporated the comments of the SNMP directorate.

     The ifIndexType textual convention was added and used as the type
     for all index objects.

     The enumeration xidDetection of the lapbAdmnStationType was
     changed to dxe to be consistent with other similar enumerations.

     Conformance statements were added at before every table as ASN.1
     comments.

June 12, 1992

   The June 12, 1992 revision of this document (Editor's Internal
   Reference 2.9) incorporated some clarifications and updated the
   status.

     The range on PositiveInteger was changed to start at 0 rather than
     1.

     The syntax of lapbXidIndex was changed to PositiveInteger.

     A value of dxe was added to lapbOperStationType.

     The range of lapbAdmnN2RxmitCount was change to (0..65535).

     The definition of ifInOctets, ifInUcastPkts, ifInErrors,
     ifInUnknownProtos, ifOutOctets, and ifoutUcastPkts was clarified.

May 18, 1992

    The May 18, 1992 revision of this document (Editor's Internal
    Reference 2.8) incorporated the following changes:

        The states of lapbFlowCurrentMode were redefined.

        The default value for lapbAdmnControlField was changed from
        module8 to modulo8.

April 8, 1992

    The April 8, 1992 revision of this document (Editor's Internal
    Reference 2.4) incorporated the following changes:

        All reference comments in the MIB were moved to the REFERENCE
        field of the OBJECT-TYPE macro.

        A type of PositiveInteger was introduced and used for common
        integer values including all timers. This effectively made the
        maximum value for timers 2147483646 milliseconds. The type of the
        frame size was changed to positiveInteger.

        The reference to ISO 7776 has been broadened to say the MIB
        descriptions use the terminology of ISO 7776.

        A comment was added to the overview section discussing creation
        and deletion of tables.

        The objects in the lapbParmTable and lapbDefTable were
        redistributed to create a lapbOperTable, a lapbAdmnTable, and a
        lapbXidTable. The lapbParmTable and lapbDefTable were deleted.
        Objects were included in the Admn table for t3 and t4.

        An object identifier was added to identify the protocol version.

        A DEFVAL clause was added for all writable objects.

        Some more overview text was included.

February 1992

    The February 1992 revision of this document (Editor's Internal
    Reference 1.17) incorporated the following changes:

        The name was changed from HDLC to LAPB. This change was made
        because other flavors of HDLC such as LAPD, SDLC, and raw HDLC
        framing, are different enough that this MIB will not adequately

manage them.

The Historical Perspective section at the beginning of the
document has been replaced with a more concise Network Management
Framework section.

The name lapbParmKWindowSize was changed to
lapbParmTransmitKWindowSize and the object
lapbParmReceiveKWindowSize was added. This change was made because
section 5.7.4 of ISO 7776 and Table 3 of ISO 8885 have provisions
for different values for the transmit and receive window size.

The name lapbParmN1FrameSize was changed to
lapbParmTransmitN1FrameSize and the object
lapbParmReceiveN1FrameSize was added. This change was made because
section 5.7.3 of ISO 7776 and Table 3 of ISO 8886 have provisions
for different values for the transmit and receive maximum frame
size.

The object lapbParmPortIndex was deleted and the description of
lapbParmPortId was changed. The object lapbParmPortId now
identifies an instance of the index object for the MIB of the
physical device or interface below LAPB.

The units for the timers were changed to Milliseconds to be
consistent with ISO 8885; see table 3.

The objects lapbParamT2AckDelayTimer and
lapbParamT3DisconnectTimer both allow values of 0 to indicate the
timer is not being used.

The object lapbParamT4IdleTimer has a value to indicate timer not
in use.

The object lapbFlowXidReceived was added to the flow table.

The lapbDefTable was added.

Ranges and sizes were added for all INTEGERs and OCTET STRINGs
that didn't have them.

October 1991

   The October 1991 revision of this document basically changed the name
   from LAPB to HDLC to make the objects more appropriate for a broader
   range of uses. A number of minor changes were made to bring the
   objects in line with established conventions. These changes are as
   follows.

The enumerated values of hdlcParmStationType were renumbered from
0 and 1 to 1 and 2.

The object hdlcFlowBusyDefer was renamed hdlcFlowBusyDefers.

The object hdlcFlowRejSent was rename hdlcFlowRejOutPkts.

The object hdlcFlowRejReceived was renamed hdlcFlowRejInPkts.

June 1991

The June revision of this document incorporated much of the E-mail
discussion of the first draft. In particular it replaced the
lapbStatTable (and all contents) with the lapbFlowTable.

April 1991

The April 24 version of this document was the first release. At that
time this document was basically a bunch of objects synthesized from
various vendor MIBs and a quick reading of ISO 7776 [10]. On first
reading it appeared to instrument too many LAPB normal functions and
too few exceptional conditions. The lapbStatTable was too long and
needed to be redone.

6. Acknowledgements

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7. References

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       Management Information for TCP/IP-based internets", STD 16, RFC
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exchange between systems - High-level data link control (HDLC)
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and format", International Organization for Standardization,
International Standard 8885.

8. Security Considerations

   Security issues are not discussed in this memo.

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