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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.

Table of Contents

1. The Network Management Framework 2
2. Objects 2
2.1 Format of Definitions 3
3. Overview 3
3.1 Informal overview 3
3.2 Textual Conventions 4
3.3 Formal overview 4
3.4 Tables 5
3.5 Traps 6
4. Object Definitions 6
5. Appendix: Revision History 27
July 30, 1992 27
June 12, 1992 27
May 18, 1992 28
April 8, 1992 28
February 1992 28
October 1991 29
June 1991 30
April 1991 30

6. Acknowledgements 30
7. References 31
8. Security Considerations 33
9. Authors' Addresses 33

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
```

```
                        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
```

```
                          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,
                          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 }
```

```
          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
```

```
                        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
                        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,
                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

This document was produced by the x25mib working group:

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7. References

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8. Security Considerations

Security issues are not discussed in this memo.

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