                Management Information Base for Frame Relay DTEs
                                Using SMIv2

1. Status of this Memo

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

2. 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 Frame Relay interfaces
   on DTEs.

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3. The SNMPv2 Network Management Framework

   The major components of the SNMPv2 Network Management framework are
   described in the documents listed below.

   o   RFC 1902 [1] defines the Structure of Management
          Information (SMI), the mechanisms used for describing and
          naming objects for the purpose of management.

   o   STD 17, RFC 1213 [2] defines MIB-II, the core set of
          managed objects (MO) for the Internet suite of protocols.

   o   RFC 1905 [3] defines the protocol used for network access
          to managed objects.

   The framework is adaptable/extensible by defining new MIBs to suit
   the requirements of specific applications/protocols/situations.

   Managed objects are accessed via a virtual information store, the
   MIB. Objects in the MIB are defined using the subset of Abstract
   Syntax Notation One (ASN.1) defined in the SMI. In particular, each
   object type is named by an OBJECT IDENTIFIER, which is an
   administratively assigned name. The object type together with an
   object instance serves to uniquely identify a specific instantiation
   of the object. For human convenience, often a textual string, termed
   the descriptor, is used to refer to the object type.

4. Overview

4.1. Frame Relay Operational Model

   For the purposes of understanding this document, Frame Relay is
   viewed as a multi-access media, not as a group of point- to-point
   connections. This model proposes that Frame Relay is a single
   interface to the network (physical connection) with many destinations
   or neighbors (virtual connections). This view enables a network
   manager the ability to group all virtual connections with their
   corresponding physical connection thereby allowing simpler
   diagnostics and trouble shooting.

   With the extension of the interfaces MIB, it is possible to configure
   frame relay DLCs as individual interfaces and create ifTable entries
   for each. This is not recommended and is not directly supported by
   this MIB. Additionally, in the presence of demand circuits creation
   of individual ifEntries for each is not possible.

Should the user wish to group DLCs together to associate them with a
higher layer, or to associate a DLC with an unnumbered point-to-point
service, the frame relay DTE MIB provides an entry in the
frCircuitEntry record. For example, suppose one were to configure a
company proprietary protocol to run above several of the frame relay
VCs. The basic layering would look something like the following:

```
    IP (ipaddrEntry 1 )  IP (ipaddrEntry 2)  IP (ipaddrEntry 3)
          |                    |                   |
          |                    |                   |
          |                    |             proprietary protocol
          |                    |             layer    (ifIndex 3)
          |                    |                   |
          |                    |                   |
    DLCI 20               DLCI 30             DLCI 40/41/42
    (ifIndex 2)           (ifIndex 2)         (ifIndex 2,
                                                logical ifIndex 3)
          |                    |                   |
          |                    |                   |
          |_____|_____|
                               |
                               |
              FR   DLMCI (ifIndex.2)
                               |
                               |
              Physical Interface (ifIndex.1)
```
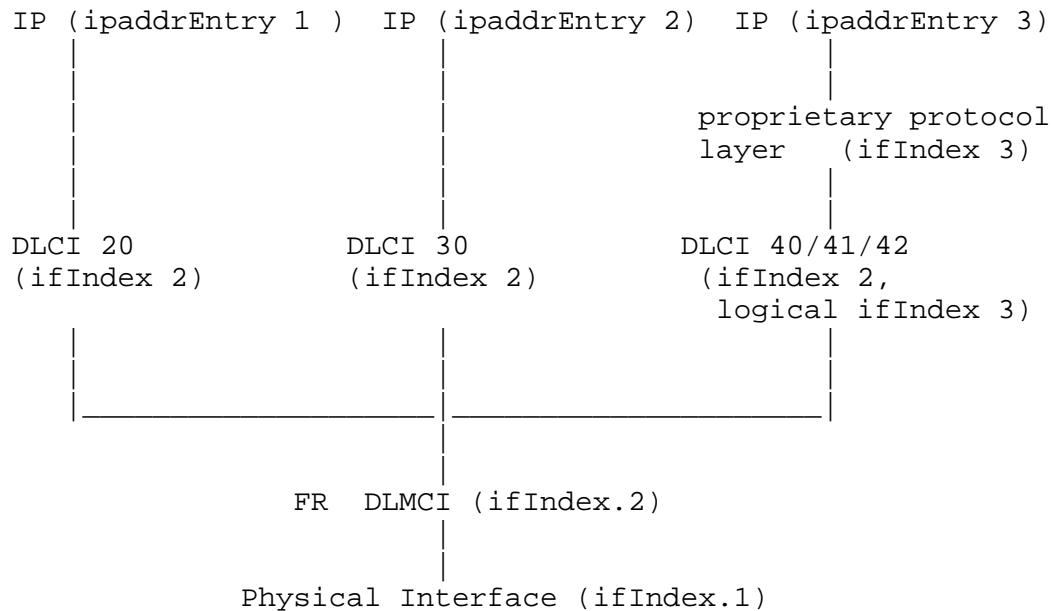
A configuration which specified that DLCI 40, 41,and 42 were associated
with a proprietary protocol layer, while DLCI 20 and 30 were to run IP
directly can now be expressed using a combination of frCircuitIfIndex
and frCircuitLogicalIfIndex. In this particular case DLCIs 40, 41 and
42 would use frCircuitIfIndex equal to the frame relay interface level
(2) while their frCircuitLogicalIfIndex would indicate the proprietary
protocol (3). DLCIs 20 and 30 would have both instances set to the frame
relay interface (2).

```
      Object              Meaning for Frame Relay Interface
      _____              _____

      ifDescr             As per DESCRIPTION in RFC 1573.
      ifType              The value allocated for Frame Relay
                          Interfaces - frameRelay (32).

      ifMtu               Set to maximum frame size in octets for
                          this frame relay interface.
```

        ifSpeed   The access rate for the frame relay
                             interface. This could be different from
                             the speed of the underlying physical
                             interface, e.g. in a fractional T1 case
                             the access rate could be 384 kbits/s (the
                             value reported in this object) whereas the
                             speed of the underlying interface would be
                             1.544 Mbits/s (the value reported in the
                             instance of ifSpeed for the ifEntry with
                             type ds1).

        ifPhysAddress   The primary address for this interface
                             assigned by the Frame Relay interface
                             provider. An octet string of zero length
                             if no address is used for this interface.

        ifAdminStatus   As per DESCRIPTION in RFC 1573.

        ifOperStatus   As per DESCRIPTION in RFC 1573.

        ifLastChange   As per DESCRIPTION in RFC 1573.

        ifInOctets   The number of received octets. This
                             includes not only the information field
                             (user data) but also the frame relay header
                             and CRC.

        ifInUcastPkts   The number of frames received on non-
                             multicast DLCIs

        ifInDiscards   The number of frames that were successfully
                             received but were discarded because of
                             format errors or because the VC was not
                             known. Format errors, in this case, are
                             any errors which would prevent the system
                             from recognizing the DLCI and placing the
                             error in the frCircuitDiscard category.

        ifInErrors   The number of received frames that are
                             discarded, because of an error.
                             Possible errors can be the following: the
                             frame relay frames were too long or were
                             too short, the frames had an invalid or
                             unrecognized DLCI values, or incorrect
                             header values.

   ifInUnknownProtos Number of unknown or unsupported
                      upper layer protocol frames received
                      and discarded.

   ifOutOctets   The number of received octets. This
                      includes not only the information field
                      (user data) but also the frame relay header
                      and CRC.

   ifOutUcastpkts   The number of frames sent.

   ifOutDiscards   The number of frames discarded in the
                      transmit direction.

   ifOutErrors   The number of frames discarded in the
                      egress direction, because of errors.

   ifName   As per DESCRIPTION in RFC 1573.

   ifInMulticastPkts The number of unerrored frames received
                      on a multicast DLCI.

   ifInBroadcastPKTS Always zero (0) as there are no broadcast
                      frames.

   ifOutMulticastPkts The number of frames transmitted over a
                      multicast DLCI.

   ifOutBroadcastPkts Always zero (0) as there are no broadcast
                      frames.

   ifHCInOctets   Only required when ifSpeed >= 155 Mbits/s.
   See

                      details for ifInOctets.

   ifHCOutOctets   Only required when ifSpeed >= 155 Mbits/s.
   See

                      details for ifInOctets.

   ifLinkUpDownTrapEnble As per DESCRIPTION in RFC 1573.

   ifHighSpeed   The access rate of the frame relay interface
                      measured in Mbits/s. If the access rate is
                      less than 1 Mbits/s, this object returns 0.

   ifPromiscuousMode Set to false(2).

   ifConnectorPresent Set to false(2).

4.2. Textual Conventions

   One new data type is introduced as a textual convention in this MIB
   document. This textual convention enhances the readability of the
   specification and can ease comparison with other specifications if
   appropriate. It should be noted that the introduction of this
   textual conventions has no effect on either the syntax nor the
   semantics of any managed objects. The use of this 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 this textual conventions which is
   adopted merely for the convenience of readers and writers in pursuit
   of the elusive goal of clear, concise, and unambiguous MIB documents.

   The new data type is DLCI. DLCI refers to the range 0..DLCINumber,
   and is used to refer to the valid Data Link Connection Indices.
   DLCINumber is, by definition, the largest possible DLCI value
   possible under the configured Q.922 Address Format.

4.3. Structure of MIB

   The MIB is composed of three groups, one defining the Data Link
   Connection Management Interface (DLCMI), one describing the Circuits,
   and a third describing errors.

   During normal operation, Frame Relay virtual circuits will be added,
   deleted and change availability. The occurrence of such changes is of
   interest to the network manager and therefore, one trap is defined,
   intended to be corollary to the SNMP "Link Up" and "Link Down" traps.

5. Changes from RFC 1315

   Below are listed the changes from the previously published version
   this document, which was RFC 1315:

   o   The MIB module was converted from SMIv1 to SMIv2 format.
          Note: due to this, the table indices have access of
          "read-only" instead of "not-accessible", which is the
          typical value for index objects in SMIv2.

   o   The module name was changed from RFC1315-MIB to FRAME-
          RELAY-DTE-MIB.

   o   The textual convention "Index" was dropped from the MIB
          module and "InterfaceIndex" from the interfaces MIB
          module, IF-MIB, was used in its place.

o   Objects frDlcmiStatus and frDlcmiRowStatus were added to
      table frDlcmiTable.

o   Added values "itut933A(5)" (from CCITT Q933 Annex A) and
      "ansiT1617D1994(6)" (from ANSI T1.617a-1994 Annex D) to
      the enumerations for object frDlcmiState.

o   The labels for the enumerated values for object
      frDlcmiAddressLen were renamed to remove their hyphens as
      required by SMIv2.

o   Added clarification that the "management virtual circuit"
      (i.e. DLCI 0) is a member of the circuit table.

o   Added the following objects to table frCircuitTable:
      frCircuitMulticast, frCircuitType, frCircuitDiscards,
      frCircuitReceivedDEs, frCircuitSentDEs,
      frCircuitLogicalIfIndex, and frCircuitRowStatus.

o   The definition of object frCircuitReceivedOctets was
      clarified as to which octets were counted.

o   Added the objects frErrFaults and frErrFaultTime to table
      frErrTable.

o   Added clarification to the values of object frErrType.

o   Added size on definition of object frErrData and
      clarified what data to capture.

o   Changed identifiier for OID value { frameDelayDTE 4 }
      from frame-relay-globals to frameRelayTrapControl.

o   Added object frTrapMaxRate.

o   Created object groups frPortGroup, frCircuitGroup,
      frTrapGroup, frErrGroup, frPortGroup0, frCircuitGroup0,
      frTrapGroup0, and frErrGroup0.

o   Created notification group frNotificationGroup.

o   Created module compliances frCompliance and
      frCompliance0.

o   Added ranges to objects frCircuitCommittedBurst,
      frCircuitExcessBurst, and frCircuitThroughput.

6. Definitions

          FRAME-RELAY-DTE-MIB DEFINITIONS ::= BEGIN

          IMPORTS
                      MODULE-IDENTITY, OBJECT-TYPE, Counter32,
                      Integer32, NOTIFICATION-TYPE   FROM SNMPv2-SMI
                      TEXTUAL-CONVENTION, RowStatus, TimeStamp FROM SNMPv2-TC
                      MODULE-COMPLIANCE, OBJECT-GROUP,
                      NOTIFICATION-GROUP   FROM SNMPv2-CONF
                      transmission   FROM RFC1213-MIB
                      InterfaceIndex   FROM IF-MIB;

          -- Frame Relay DTE MIB

          frameRelayDTE MODULE-IDENTITY
              LAST-UPDATED "9705010229Z" -- Thu May 1 02:29:46 PDT 1997
              ORGANIZATION "IETF IPLPDN Working Group"
              CONTACT-INFO
                  "   Caralyn Brown
                  Postal: Cadia Networks, Inc.
                          1 Corporate Drive
                          Andover, Massachusetts 01810
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              DESCRIPTION
                  "The MIB module to describe the use of a Frame Relay
                  interface by a DTE."
              REVISION "9705010229Z" -- Thu May 1 02:29:46 PDT 1997
              DESCRIPTION
                  "Converted from SMIv1 to SMIv2. (Thus, indices are
                  read-only rather than being not-accessible.) Added
                  objects and made clarifications based on implementation
                  experience."

              REVISION "9204010000Z"
              DESCRIPTION
                  "Published as RFC 1315, the initial version of this MIB
                  module."
              ::= { transmission 32 }

```
     --
     --       the range of a Data Link Connection Identifier
     --
     DLCI ::= TEXTUAL-CONVENTION
         STATUS       current
         DESCRIPTION
           "The range of DLCI values.  Note that this varies by
           interface configuration; normally, interfaces may use
           0..1023, but may be configured to use ranges as large
           as 0..2^23."
         SYNTAX       Integer32(0..8388607)



     --

     -- Data Link Connection Management Interface

     --       The variables that configure the DLC Management Interface.

     frDlcmiTable OBJECT-TYPE
         SYNTAX    SEQUENCE OF FrDlcmiEntry
         MAX-ACCESS   not-accessible
         STATUS    current
         DESCRIPTION
            "The Parameters for the Data Link Connection Management
            Interface for the frame relay service on this
            interface."
         REFERENCE
            "American National Standard T1.617-1991, Annex D"
         ::= { frameRelayDTE 1 }

     frDlcmiEntry OBJECT-TYPE
         SYNTAX    FrDlcmiEntry
         MAX-ACCESS   not-accessible
         STATUS    current
         DESCRIPTION
            "The Parameters for a particular Data Link Connection
            Management Interface."
         INDEX { frDlcmiIfIndex }
         ::= { frDlcmiTable 1 }
```

```
     FrDlcmiEntry ::=
         SEQUENCE {
             frDlcmiIfIndex                 InterfaceIndex,
             frDlcmiState                   INTEGER,
             frDlcmiAddress                 INTEGER,
             frDlcmiAddressLen              INTEGER,
             frDlcmiPollingInterval         Integer32,
             frDlcmiFullEnquiryInterval     Integer32,
             frDlcmiErrorThreshold          Integer32,
             frDlcmiMonitoredEvents         Integer32,
             frDlcmiMaxSupportedVCs         DLCI,
             frDlcmiMulticast               INTEGER,
             frDlcmiStatus                  INTEGER,
             frDlcmiRowStatus               RowStatus
         }


     frDlcmiIfIndex OBJECT-TYPE

         SYNTAX    InterfaceIndex
         MAX-ACCESS    read-only
         STATUS    current
         DESCRIPTION
             "The ifIndex value of the corresponding ifEntry."
         ::= { frDlcmiEntry 1 }


     frDlcmiState OBJECT-TYPE
         SYNTAX INTEGER      {
             noLmiConfigured (1),
             lmiRev1         (2),
             ansiT1617D      (3),   -- ANSI T1.617 Annex D
             ansiT1617B      (4),   -- ANSI T1.617 Annex B
             itut933A        (5),   -- CCITT Q933 Annex A
             ansiT1617D1994  (6)    -- ANSI T1.617a-1994 Annex D
         }
         MAX-ACCESS    read-create
         STATUS    current
         DESCRIPTION
             "This variable states which Data Link Connection
             Management scheme is active (and by implication, what
             DLCI it uses) on the Frame Relay interface."
         REFERENCE
             "American National Standard T1.617-1991, American
             National Standard T1.617a-1994, ITU-T Recommendation
             Q.933 (03/93)."

         ::= { frDlcmiEntry 2 }
```

        frDlcmiAddress OBJECT-TYPE
            SYNTAX   INTEGER {
                        q921   (1), -- 13 bit DLCI
                        q922March90   (2), -- 11 bit DLCI
                        q922November90 (3), -- 10 bit DLCI
                        q922   (4)   -- Final Standard
            }
            MAX-ACCESS read-create
            STATUS current
            DESCRIPTION
               "This variable states which address format is in use on
               the Frame Relay interface."
            ::= { frDlcmiEntry 3 }

        frDlcmiAddressLen OBJECT-TYPE
            SYNTAX   INTEGER   {
                    twoOctets (2),
                    threeOctets (3),
                    fourOctets (4)
            }
            MAX-ACCESS read-create
            STATUS current
            DESCRIPTION
               "This variable states the address length in octets. In
               the case of Q922 format, the length indicates the
               entire length of the address including the control
               portion."
            ::= { frDlcmiEntry 4 }

        frDlcmiPollingInterval OBJECT-TYPE
            SYNTAX   Integer32 (5..30)
            UNITS   "seconds"
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
               "This is the number of seconds between successive
               status enquiry messages."
            REFERENCE
               "American National Standard T1.617-1991, Section D.7
               Timer T391."
            DEFVAL { 10 }
            ::= { frDlcmiEntry 5 }

        frDlcmiFullEnquiryInterval OBJECT-TYPE
            SYNTAX   Integer32 (1..255)
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
                "Number of status enquiry intervals that pass before
                issuance of a full status enquiry message."
            REFERENCE
                "American National Standard T1.617-1991, Section D.7
                Counter N391."
            DEFVAL { 6 }
            ::= { frDlcmiEntry 6 }

        frDlcmiErrorThreshold OBJECT-TYPE
            SYNTAX   Integer32 (1..10)
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
                "This is the maximum number of unanswered Status
                Enquiries the equipment shall accept before declaring
                the interface down."
            REFERENCE
                "American National Standard T1.617-1991, Section D.5.1
                Counter N392."
            DEFVAL { 3 }
            ::= { frDlcmiEntry 7 }

        frDlcmiMonitoredEvents OBJECT-TYPE
            SYNTAX   Integer32 (1..10)
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
                "This is the number of status polling intervals over
                which the error threshold is counted. For example, if
                within 'MonitoredEvents' number of events the station
                receives 'ErrorThreshold' number of errors, the
                interface is marked as down."
            REFERENCE
                "American National Standard T1.617-1991, Section D.5.2
                Counter N393."
            DEFVAL { 4 }
            ::= { frDlcmiEntry 8 }

          frDlcmiMaxSupportedVCs OBJECT-TYPE
              SYNTAX   DLCI
              MAX-ACCESS   read-create
              STATUS   current
              DESCRIPTION
                 "The maximum number of Virtual Circuits allowed for
                 this interface. Usually dictated by the Frame Relay
                 network.

                 In response to a SET, if a value less than zero or
                 higher than the agent's maximal capability is
                 configured, the agent should respond badValue"
              ::= { frDlcmiEntry 9 }

          frDlcmiMulticast OBJECT-TYPE
              SYNTAX   INTEGER   {
                         nonBroadcast (1),
                         broadcast (2)
                         }
              MAX-ACCESS   read-create
              STATUS   current
              DESCRIPTION
                 "This indicates whether the Frame Relay interface is
                 using a multicast service."
              ::= { frDlcmiEntry 10 }

          frDlcmiStatus OBJECT-TYPE
              SYNTAX   INTEGER   {
                         running   (1),   -- init complete, system running
                         fault   (2),   -- error threshold exceeded
                         initializing (3)   -- system start up
                         }
              MAX-ACCESS   read-only
              STATUS   current
              DESCRIPTION
                 "This indicates the status of the Frame Relay interface
                 as determined by the performance of the dlcmi. If no
                 dlcmi is running, the Frame Relay interface will stay
                 in the running state indefinitely."
              ::= { frDlcmiEntry 11 }

        frDlcmiRowStatus OBJECT-TYPE
            SYNTAX   RowStatus
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
               "SNMP Version 2 Row Status Variable. Writable objects
                in the table may be written in any RowStatus state."
            ::= { frDlcmiEntry 12 }

        --
        -- A Frame Relay service is a multiplexing service. Data
        -- Link Connection Identifiers enumerate virtual circuits
        -- (permanent or dynamic) which are layered onto the underlying
        -- circuit, represented by ifEntry. Therefore, each of the entries
        -- in the Standard MIB's Interface Table with an IfType of
        -- Frame Relay represents a Q.922 interface. Zero or more
        -- virtual circuits are layered onto this interface and provide
        -- interconnection with various remote destinations.
        -- Each such virtual circuit is represented by an entry in the
        -- circuit table. The management virtual circuit (i.e. DLCI 0)
        -- is a virtual circuit by this definition and will be represented
        -- with an entry in the circuit table.

        --   Circuit Table

        -- The table describing the use of the DLCIs attached to
        -- each Frame Relay Interface.

        frCircuitTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF FrCircuitEntry
            MAX-ACCESS   not-accessible
            STATUS   current
            DESCRIPTION
               "A table containing information about specific Data
                Link Connections (DLC) or virtual circuits."
            ::= { frameRelayDTE 2 }

      frCircuitEntry OBJECT-TYPE
          SYNTAX   FrCircuitEntry
          MAX-ACCESS   not-accessible
          STATUS   current
          DESCRIPTION
             "The information regarding a single Data Link
             Connection. Discontinuities in the counters contained
             in this table are indicated by the value in
             frCircuitCreationTime."
          INDEX { frCircuitIfIndex, frCircuitDlci }
          ::= { frCircuitTable 1 }

      FrCircuitEntry ::=
          SEQUENCE {
              frCircuitIfIndex   InterfaceIndex,
              frCircuitDlci   DLCI,
              frCircuitState   INTEGER,
              frCircuitReceivedFECNs   Counter32,
              frCircuitReceivedBECNs   Counter32,
              frCircuitSentFrames   Counter32,
              frCircuitSentOctets   Counter32,
              frCircuitReceivedFrames   Counter32,
              frCircuitReceivedOctets   Counter32,
              frCircuitCreationTime   TimeStamp,
              frCircuitLastTimeChange   TimeStamp,
              frCircuitCommittedBurst   Integer32,
              frCircuitExcessBurst   Integer32,
              frCircuitThroughput   Integer32,
              frCircuitMulticast   INTEGER,
              frCircuitType   INTEGER,
              frCircuitDiscards   Counter32,
              frCircuitReceivedDEs   Counter32,
              frCircuitSentDEs   Counter32,
              frCircuitLogicalIfIndex   InterfaceIndex,
              frCircuitRowStatus   RowStatus
          }

      frCircuitIfIndex OBJECT-TYPE
          SYNTAX   InterfaceIndex
          MAX-ACCESS   read-only
          STATUS   current
          DESCRIPTION
             "The ifIndex Value of the ifEntry this virtual circuit
             is layered onto."
          ::= { frCircuitEntry 1 }

       frCircuitDlci OBJECT-TYPE
           SYNTAX   DLCI
           MAX-ACCESS   read-only
           STATUS   current
           DESCRIPTION
              "The Data Link Connection Identifier for this virtual
              circuit."
           REFERENCE
              "American National Standard T1.618-1991, Section 3.3.6"
           ::= { frCircuitEntry 2 }

       frCircuitState OBJECT-TYPE
           SYNTAX   INTEGER   {

                       invalid (1),
                       active (2),
                       inactive (3)
                      }
           MAX-ACCESS   read-create
           STATUS   current
           DESCRIPTION
              "Indicates whether the particular virtual circuit is
              operational. In the absence of a Data Link Connection
              Management Interface, virtual circuit entries (rows)
              may be created by setting virtual circuit state to
              'active', or deleted by changing Circuit state to
              'invalid'.

              Whether or not the row actually disappears is left to
              the implementation, so this object may actually read as
              'invalid' for some arbitrary length of time. It is
              also legal to set the state of a virtual circuit to
              'inactive' to temporarily disable a given circuit.

              The use of 'invalid' is deprecated in this SNMP Version
              2 MIB, in favor of frCircuitRowStatus."
           DEFVAL { active }
           ::= { frCircuitEntry 3 }

        frCircuitReceivedFECNs OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "Number of frames received from the network indicating
               forward congestion since the virtual circuit was
               created. This occurs when the remote DTE sets the FECN
               flag, or when a switch in the network enqueues the
               frame to a trunk whose transmission queue is
               congested."
            REFERENCE
               "American National Standard T1.618-1991, Section 3.3.3"
            ::= { frCircuitEntry 4 }

        frCircuitReceivedBECNs OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only

            STATUS   current
            DESCRIPTION
               "Number of frames received from the network indicating
               backward congestion since the virtual circuit was
               created. This occurs when the remote DTE sets the BECN
               flag, or when a switch in the network receives the
               frame from a trunk whose transmission queue is
               congested."
            REFERENCE
               "American National Standard T1.618-1991, Section 3.3.4"
            ::= { frCircuitEntry 5 }

        frCircuitSentFrames OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The number of frames sent from this virtual circuit
               since it was created."
            ::= { frCircuitEntry 6 }

        frCircuitSentOctets OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current

            DESCRIPTION
               "The number of octets sent from this virtual circuit
               since it was created. Octets counted are the full
               frame relay header and the payload, but do not include
               the flag characters or CRC."
            ::= { frCircuitEntry 7 }

        frCircuitReceivedFrames OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "Number of frames received over this virtual circuit
               since it was created."
            ::= { frCircuitEntry 8 }

        frCircuitReceivedOctets OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "Number of octets received over this virtual circuit
               since it was created. Octets counted include the full
               frame relay header, but do not include the flag
               characters or the CRC."
            ::= { frCircuitEntry 9 }

        frCircuitCreationTime OBJECT-TYPE
            SYNTAX   TimeStamp
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The value of sysUpTime when the virtual circuit was
               created, whether by the Data Link Connection Management
               Interface or by a SetRequest."
            ::= { frCircuitEntry 10 }

        frCircuitLastTimeChange OBJECT-TYPE
            SYNTAX   TimeStamp
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The value of sysUpTime when last there was a change in
               the virtual circuit state"
            ::= { frCircuitEntry 11 }

        frCircuitCommittedBurst OBJECT-TYPE
            SYNTAX   Integer32(0..2147483647)
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
               "This variable indicates the maximum amount of data, in
               bits, that the network agrees to transfer under normal
               conditions, during the measurement interval."
            REFERENCE
               "American National Standard T1.617-1991, Section
               6.5.19"
            DEFVAL   { 0 } -- the default indicates no commitment
            ::= { frCircuitEntry 12 }

        frCircuitExcessBurst OBJECT-TYPE
            SYNTAX   Integer32(0..2147483647)
            MAX-ACCESS   read-create
            STATUS   current
            DESCRIPTION
               "This variable indicates the maximum amount of
               uncommitted data bits that the network will attempt to
               deliver over the measurement interval.

               By default, if not configured when creating the entry,
               the Excess Information Burst Size is set to the value
               of ifSpeed."
            REFERENCE
               "American National Standard T1.617-1991, Section
               6.5.19"
            ::= { frCircuitEntry 13 }

       frCircuitThroughput OBJECT-TYPE
           SYNTAX   Integer32(0..2147483647)
           MAX-ACCESS   read-create
           STATUS   current
           DESCRIPTION

```
             "Throughput is the average number of 'Frame Relay
             Information Field' bits transferred per second across a
             user network interface in one direction, measured over
             the measurement interval.

             If the configured committed burst rate and throughput
             are both non-zero, the measurement interval, T, is
                 T=frCircuitCommittedBurst/frCircuitThroughput.

             If the configured committed burst rate and throughput
             are both zero, the measurement interval, T, is
                       T=frCircuitExcessBurst/ifSpeed."
         REFERENCE
             "American National Standard T1.617-1991, Section
             6.5.19"
         DEFVAL {0}  -- the default value of Throughput is
                     -- "no commitment".
         ::= { frCircuitEntry 14 }


     frCircuitMulticast OBJECT-TYPE
         SYNTAX    INTEGER    {
                     unicast  (1),
                     oneWay   (2),
                     twoWay   (3),
                     nWay     (4)
                     }
         MAX-ACCESS   read-create
         STATUS    current
         DESCRIPTION
             "This indicates whether this VC is used as a unicast VC
             (i.e. not multicast) or the type of multicast service
             subscribed to"
         REFERENCE
             "Frame Relay PVC Multicast Service and Protocol
             Description Implementation: FRF.7 Frame Relay Forum
             Technical Committe October 21, 1994"
               DEFVAL {unicast}
                         -- the default value of frCircuitMulticast is
                         -- "unicast" (not a multicast VC).
             ::= { frCircuitEntry 15 }


     frCircuitType OBJECT-TYPE
         SYNTAX    INTEGER    {
                     static  (1),
                     dynamic (2)
                 }
```

        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
           "Indication of whether the VC was manually created
           (static), or dynamically created (dynamic) via the data
           link control management interface."
        ::= { frCircuitEntry 16 }

    frCircuitDiscards OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
           "The number of inbound frames dropped because of format
           errors, or because the VC is inactive."
        ::= { frCircuitEntry 17 }

    frCircuitReceivedDEs OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
           "Number of frames received from the network indicating
           that they were eligible for discard since the virtual
           circuit was created. This occurs when the remote DTE
           sets the DE flag, or when in remote DTE's switch
           detects that the frame was received as Excess Burst
           data."
        REFERENCE
           "American National Standard T1.618-1991, Section 3.3.4"
        ::= { frCircuitEntry 18 }

    frCircuitSentDEs OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
           "Number of frames sent to the network indicating that
           they were eligible for discard since the virtual
           circuit was created. This occurs when the local DTE
           sets the DE flag, indicating that during Network
           congestion situations those frames should be discarded
           in preference of other frames sent without the DE bit
           set."
        REFERENCE

          "American National Standard T1.618-1991, Section
          3.3.4"
       ::= { frCircuitEntry 19 }

    frCircuitLogicalIfIndex OBJECT-TYPE
       SYNTAX InterfaceIndex
       MAX-ACCESS read-create
       STATUS current
       DESCRIPTION
          "Normally the same value as frDlcmiIfIndex, but
          different when an implementation associates a virtual
          ifEntry with a DLC or set of DLCs in order to associate
          higher layer objects such as the ipAddrEntry with a
          subset of the virtual circuits on a Frame Relay
          interface. The type of such ifEntries is defined by the
          higher layer object; for example, if PPP/Frame Relay is
          implemented, the ifType of this ifEntry would be PPP.
          If it is not so defined, as would be the case with an
          ipAddrEntry, it should be of type Other."
       ::= { frCircuitEntry 20 }

    frCircuitRowStatus OBJECT-TYPE
       SYNTAX   RowStatus
       MAX-ACCESS   read-create
       STATUS   current
       DESCRIPTION
          "This object is used to create a new row or modify or
          destroy an existing row in the manner described in the
          definition of the RowStatus textual convention.
          Writable objects in the table may be written in any
          RowStatus state."
       ::= { frCircuitEntry 21 }

    --
    -- Error Table

    -- The table describing errors encountered on each Frame
    -- Relay Interface.

    frErrTable OBJECT-TYPE
       SYNTAX   SEQUENCE OF FrErrEntry
       MAX-ACCESS   not-accessible
       STATUS   current
       DESCRIPTION
          "A table containing information about Errors on the
          Frame Relay interface. Discontinuities in the counters
          contained in this table are the same as apply to the

```
           ifEntry associated with the Interface."
        ::= { frameRelayDTE 3 }


     frErrEntry OBJECT-TYPE
         SYNTAX   FrErrEntry
         MAX-ACCESS   not-accessible
         STATUS   current
         DESCRIPTION
            "The error information for a single frame relay
            interface."
         INDEX { frErrIfIndex }
         ::= { frErrTable 1 }



     FrErrEntry ::=
         SEQUENCE {
             frErrIfIndex           InterfaceIndex,
             frErrType              INTEGER,
             frErrData              OCTET STRING,
             frErrTime              TimeStamp,
             frErrFaults            Counter32,
             frErrFaultTime         TimeStamp
     }



     frErrIfIndex OBJECT-TYPE
         SYNTAX   InterfaceIndex
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
            "The ifIndex Value of the corresponding ifEntry."
         ::= { frErrEntry 1 }


         frErrType OBJECT-TYPE
            SYNTAX   INTEGER    {
                     unknownError(1),
                     receiveShort(2),
                     receiveLong(3),
                     illegalAddress(4),
                     unknownAddress(5),
                     dlcmiProtoErr(6),
                     dlcmiUnknownIE(7),
                     dlcmiSequenceErr(8),
                     dlcmiUnknownRpt(9),
                     noErrorSinceReset(10)
                 }
```

```
            MAX-ACCESS    read-only
            STATUS    current
            DESCRIPTION
      "The type of error that was last seen  on  this interface:

      receiveShort: frame was not long enough to allow
              demultiplexing - the address field was incomplete,
              or for virtual circuits using Multiprotocol over
              Frame Relay, the protocol identifier was missing
              or incomplete.

      receiveLong: frame exceeded maximum length configured for this
                  interface.

      illegalAddress: address field did not match configured format.

      unknownAddress: frame received on a virtual circuit which was not
                    active or administratively disabled.

      dlcmiProtoErr: unspecified error occurred when attempting to
                   interpret link maintenance frame.

      dlcmiUnknownIE: link maintenance frame contained an Information
                    Element type which is not valid for the
                    configured link maintenance protocol.

      dlcmiSequenceErr: link maintenance frame contained a sequence
                      number other than the expected value.

      dlcmiUnknownRpt: link maintenance frame contained a Report Type
                     Information Element whose value was not valid
                     for the configured link maintenance protocol.

      noErrorSinceReset: no errors have been detected since the last
                       cold start or warm start."
          ::= { frErrEntry 2 }


      frErrData OBJECT-TYPE
          SYNTAX    OCTET STRING (SIZE(1..1600))
          MAX-ACCESS    read-only
          STATUS    current
          DESCRIPTION
             "An octet string containing as much of the error packet
             as possible.  As a minimum, it must contain the Q.922
             Address or as much as was delivered.  It is desirable
             to include all header and demultiplexing information."
          ::= { frErrEntry 3 }
```

        frErrTime OBJECT-TYPE
            SYNTAX   TimeStamp
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The value of sysUpTime at which the error was
               detected."
            ::= { frErrEntry 4 }

        frErrFaults OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The number of times the interface has gone down since
               it was initialized."
            ::= { frErrEntry 5 }

        frErrFaultTime OBJECT-TYPE
            SYNTAX   TimeStamp
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
               "The value of sysUpTime at the time when the interface
               was taken down due to excessive errors. Excessive
               errors is defined as the time when a DLCMI exceeds the
               frDlcmiErrorThreshold number of errors within
               frDlcmiMonitoredEvents. See FrDlcmiEntry for further
               details."
            ::= { frErrEntry 6 }

        --

        -- Frame Relay Trap Control

        frameRelayTrapControl OBJECT IDENTIFIER ::= { frameRelayDTE 4 }

        -- the following highly unusual OID is as it is for compatibility
        -- with RFC 1315, the SNMP V1 predecessor of this document.
        frameRelayTraps OBJECT IDENTIFIER ::= { frameRelayDTE 0 }

    frTrapState OBJECT-TYPE
        SYNTAX   INTEGER   { enabled(1), disabled(2) }
        MAX-ACCESS   read-write
        STATUS   current
        DESCRIPTION
           "This variable indicates whether the system produces
           the frDLCIStatusChange trap."
        DEFVAL { disabled }
        ::= { frameRelayTrapControl 1 }

    frTrapMaxRate OBJECT-TYPE
        SYNTAX   Integer32 (0..3600000)
        MAX-ACCESS   read-write
        STATUS   current
        DESCRIPTION
           "This variable indicates the number of milliseconds
           that must elapse between trap emissions. If events
           occur more rapidly, the impementation may simply fail
           to trap, or may queue traps until an appropriate time."
        DEFVAL { 0 }   -- no minimum elapsed period is specified
        ::= { frameRelayTrapControl 2 }

    -- Data Link Connection Management Interface Related Traps

    frDLCIStatusChange NOTIFICATION-TYPE
        OBJECTS { frCircuitState }
        STATUS   current

        DESCRIPTION
           "This trap indicates that the indicated Virtual Circuit
           has changed state. It has either been created or
           invalidated, or has toggled between the active and
           inactive states. If, however, the reason for the state
           change is due to the DLCMI going down, per-DLCI traps
           should not be generated."
    ::= { frameRelayTraps 1 }
    -- conformance information

    frConformance OBJECT IDENTIFIER ::= { frameRelayDTE 6 }

    frGroups   OBJECT IDENTIFIER ::= { frConformance 1 }
    frCompliances OBJECT IDENTIFIER ::= { frConformance 2 }

    -- compliance statements

```
      frCompliance MODULE-COMPLIANCE
          STATUS  current
          DESCRIPTION
            "The compliance statement "
          MODULE  -- this module
          MANDATORY-GROUPS { frPortGroup, frCircuitGroup }

          GROUP       frErrGroup
          DESCRIPTION
            "This optional group is used for debugging Frame Relay
            Systems."

          GROUP       frTrapGroup
          DESCRIPTION
            "This optional group is used for the management of
            asynchronous notifications by Frame Relay Systems."

          GROUP       frNotificationGroup
          DESCRIPTION
            "This optional group defines the asynchronous
            notifications generated by Frame Relay Systems."

          OBJECT      frDlcmiRowStatus
          MIN-ACCESS  read-only
          DESCRIPTION
            "Row creation is not required for the frDlcmiTable."

          OBJECT      frCircuitRowStatus

          MIN-ACCESS  read-only
          DESCRIPTION
            "Row creation is not required for the frCircuitTable."

          ::= { frCompliances 1 }

     frCompliance0 MODULE-COMPLIANCE
          STATUS  current
          DESCRIPTION
            "The compliance statement for objects and the trap
            defined in RFC 1315."
          MODULE  -- this module
          MANDATORY-GROUPS { frPortGroup0, frCircuitGroup0 }

          GROUP       frErrGroup0
          DESCRIPTION
            "This optional group is used for debugging Frame Relay
            Systems."
```

          GROUP   frTrapGroup0
          DESCRIPTION
             "This optional group is used for the management of
             asynchronous notifications by Frame Relay Systems."

          GROUP   frNotificationGroup
          DESCRIPTION
             "This optional group defines the asynchronous
             notifications generated by Frame Relay Systems."

          ::= { frCompliances 2 }

     -- units of conformance

     frPortGroup   OBJECT-GROUP
         OBJECTS {
                 frDlcmiIfIndex, frDlcmiState, frDlcmiAddress,
                 frDlcmiAddressLen, frDlcmiPollingInterval,
                 frDlcmiFullEnquiryInterval, frDlcmiErrorThreshold,
                 frDlcmiMonitoredEvents, frDlcmiMaxSupportedVCs,
                 frDlcmiMulticast, frDlcmiStatus, frDlcmiRowStatus
              }
         STATUS current
         DESCRIPTION
            "The objects necessary to control the Link Management
            Interface for a Frame Relay Interface as well as
            maintain the error statistics on this interface."
         ::= { frGroups 1 }

     frCircuitGroup   OBJECT-GROUP
         OBJECTS {
                 frCircuitIfIndex, frCircuitDlci, frCircuitState,
                 frCircuitReceivedFECNs, frCircuitReceivedBECNs,
                 frCircuitSentFrames, frCircuitSentOctets,
                 frCircuitReceivedFrames, frCircuitReceivedOctets,
                 frCircuitCreationTime, frCircuitLastTimeChange,
                 frCircuitCommittedBurst, frCircuitExcessBurst,
                 frCircuitThroughput, frCircuitMulticast,
                 frCircuitType, frCircuitDiscards,
                 frCircuitReceivedDEs, frCircuitSentDEs,
                 frCircuitLogicalIfIndex, frCircuitRowStatus
              }
         STATUS current
         DESCRIPTION
            "The objects necessary to control the Virtual Circuits
            layered onto a Frame Relay Interface."
         ::= { frGroups 2 }

        frTrapGroup   OBJECT-GROUP
            OBJECTS { frTrapState, frTrapMaxRate }
            STATUS   current
            DESCRIPTION
               "The objects necessary to control a Frame Relay
               Interface's notification messages."
            ::= { frGroups 3 }

        frErrGroup   OBJECT-GROUP
            OBJECTS {
                    frErrIfIndex, frErrType, frErrData, frErrTime,
                    frErrFaults, frErrFaultTime
                  }
            STATUS   current
            DESCRIPTION
               "Objects designed to assist in debugging Frame Relay
               Interfaces."
            ::= { frGroups 4 }

        frNotificationGroup NOTIFICATION-GROUP
            NOTIFICATIONS { frDLCIStatusChange }
            STATUS   current
            DESCRIPTION
               "Traps which may be used to enhance event driven
               management of the interface."
            ::= { frGroups 5 }

        frPortGroup0   OBJECT-GROUP
            OBJECTS {
                    frDlcmiIfIndex, frDlcmiState, frDlcmiAddress,
                    frDlcmiAddressLen, frDlcmiPollingInterval,
                    frDlcmiFullEnquiryInterval, frDlcmiErrorThreshold,
                    frDlcmiMonitoredEvents, frDlcmiMaxSupportedVCs,
                    frDlcmiMulticast
                  }
            STATUS   current
            DESCRIPTION
               "The objects necessary to control the Link Management
               Interface for a Frame Relay Interface as well as
               maintain the error statistics on this interface from
               RFC 1315."
            ::= { frGroups 6 }

        frCircuitGroup0   OBJECT-GROUP
            OBJECTS {
                    frCircuitIfIndex, frCircuitDlci, frCircuitState,
                    frCircuitReceivedFECNs, frCircuitReceivedBECNs,
                    frCircuitSentFrames, frCircuitSentOctets,

```
                       frCircuitReceivedFrames, frCircuitReceivedOctets,
                       frCircuitCreationTime, frCircuitLastTimeChange,
                       frCircuitCommittedBurst, frCircuitExcessBurst,
                       frCircuitThroughput
                  }
        STATUS   current
        DESCRIPTION
           "The objects necessary to control the Virtual Circuits
           layered onto a Frame Relay Interface from RFC 1315."
        ::= { frGroups 7 }

    frErrGroup0    OBJECT-GROUP
        OBJECTS {
                   frErrIfIndex, frErrType, frErrData, frErrTime
              }
        STATUS   current
        DESCRIPTION
           "Objects designed to assist in debugging Frame Relay
           Interfaces from RFC 1315."
        ::= { frGroups 8 }


    frTrapGroup0    OBJECT-GROUP
        OBJECTS { frTrapState }
        STATUS   current
        DESCRIPTION
           "The objects necessary to control a Frame Relay
           Interface's notification messages from RFC 1315."
        ::= { frGroups 9 }

    END
```

7. Security Issues

    Security issues for this MIB are entirely covered by the SNMP
    Security Architecture, and have not been expanded within the contents
    of this MIB.

8. Acknowledgments

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    Data Networks (IPLPDN) Working Group, and has since been carried on
    in the PPP Working Group, sort of. Currently, the Ion Working Group
    is its host.

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    suggestions and pastable text.

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