Network Working Group
Request for Comments: 1315

C. Brown
Wellfleet Communications, Inc.
F. Baker
Advanced Computer Communications
C. Carvalho
Advanced Computer Communications
April 1992

Management Information Base for Frame Relay DTEs

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 Frame Relay.

Table of Contents

1. The Network Management Framework

The Internet-standard Network Management Framework consists of three components. They are:

RFC 1155 which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. RFC 1212 defines a more concise description mechanism, which is wholly consistent with the SMI.

RFC 1156 which defines MIB-I, the core set of managed objects for the Internet suite of protocols. RFC 1213 defines MIB-II, an evolution of MIB-I based on implementation experience and new operational requirements.

RFC 1157 which defines the SNMP, the protocol used for network access to managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

2. Objects

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [7] defined in the SMI. In particular, each object has a name, a syntax, and an encoding. The name is an object identifier, an administratively assigned name, which specifies an object type. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the OBJECT DESCRIPTOR, to also refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for this purpose. However, the SMI [3] purposely restricts the ASN.1 constructs which may be used. These restrictions are explicitly made for simplicity.

The encoding of an object type is simply how that object type is represented using the object type's syntax. Implicitly tied to the notion of an object type's syntax and encoding is how the object type is represented when being transmitted on the network.

The SMI specifies the use of the basic encoding rules of ASN.1 [8], subject to the additional requirements imposed by the SNMP.

2.1. Format of Definitions

Section 4 contains contains the specification of all object types contained in this MIB module. The object types are defined using the conventions defined in the SMI, as amended by the extensions specified in [9,10].

3. Overview

3.1. 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.

3.2. Textual Conventions

Several new data types are introduced as a textual convention 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 the 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.

The new data types are Index and DLCI. Index refers to the range 1..ifNumber, and is used to establish the correspondence between ifEntries and Frame Relay Interfaces. 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.

3.3. 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.

4. Definitions

```
RFC1315-MIB DEFINITIONS ::= BEGIN

IMPORTS
        OBJECT-TYPE
                FROM RFC-1212
        transmission
                FROM RFC1213-MIB
        TimeTicks
                FROM RFC-1155
        TRAP-TYPE
                FROM RFC-1215;

--  Frame Relay DTE MIB

frame-relay     OBJECT IDENTIFIER ::= { transmission 32 }

--
--      the range of ifIndex
--
Index ::= INTEGER       -- 1..ifNumber

--
--      the range of a Data Link Connection Identifier
--
DLCI ::= INTEGER        -- 0..DLCINumber


--  Data Link Connection Management Interface

--      The variables that configure the DLC Management Interface.

frDlcmiTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF FrDlcmiEntry
    ACCESS   not-accessible
    STATUS   mandatory
    DESCRIPTION
       "The Parameters for the Data Link Connection Management
       Interface for the frame relay service on this
       interface."
    REFERENCE
```

```
           "Draft American National Standard T1.617-1991, Annex D"
         ::= { frame-relay 1 }

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

         FrDlcmiEntry ::=
             SEQUENCE {
                 frDlcmiIfIndex
                     Index,
                 frDlcmiState
                     INTEGER,
                 frDlcmiAddress
                     INTEGER,
                 frDlcmiAddressLen
                     INTEGER,
                 frDlcmiPollingInterval
                     INTEGER,
                 frDlcmiFullEnquiryInterval
                     INTEGER,
                 frDlcmiErrorThreshold
                     INTEGER,
                 frDlcmiMonitoredEvents
                     INTEGER,
                 frDlcmiMaxSupportedVCs
                     INTEGER,
                 frDlcmiMulticast
                     INTEGER
         }



         frDlcmiIfIndex OBJECT-TYPE
             SYNTAX   Index
             ACCESS   read-only
             STATUS   mandatory
             DESCRIPTION
                "The ifIndex value of the  corresponding  ifEn-
                try."
            ::= { frDlcmiEntry 1 }
```

```
        frDlcmiState OBJECT-TYPE
            SYNTAX INTEGER {
                noLmiConfigured (1),
                lmiRev1         (2),
                ansiT1-617-D    (3),  -- ANSI T1.617 Annex D
                ansiT1-617-B    (4)   -- ANSI T1.617 Annex B
            }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This variable states which Data  Link  Connec-
               tion Management scheme is active (and by impli-
               cation, what DLCI it uses) on the  Frame  Relay
               interface."
           REFERENCE
              "Draft American National Standard T1.617-1991"
          ::= { 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
            }
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
               "This variable states which address  format  is
               in use on the Frame Relay interface."
           ::= { frDlcmiEntry 3 }


        frDlcmiAddressLen OBJECT-TYPE
            SYNTAX  INTEGER {
                    two-octets (2),
                    three-octets (3),
                    four-octets (4)
            }
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
               "This variable states which address  length  in
               octets.  In the case of Q922 format, the length
               indicates the entire length of the address  in-
               cluding the control portion."
```

```
            ::= { frDlcmiEntry 4 }


        frDlcmiPollingInterval OBJECT-TYPE
            SYNTAX   INTEGER (5..30)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This is the number of seconds between  succes-
               sive status enquiry messages."
           REFERENCE
              "Draft American National  Standard  T1.617-1991,
              Section D.7 Timer T391."
          DEFVAL { 10 }
          ::= { frDlcmiEntry 5 }


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



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

```
frDlcmiMonitoredEvents OBJECT-TYPE
    SYNTAX   INTEGER (1..10)
    ACCESS   read-write
    STATUS   mandatory
    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
      "Draft American National  Standard  T1.617-1991,
      Section D.5.2 Counter N393."
  DEFVAL { 4 }
  ::= { frDlcmiEntry 8 }



frDlcmiMaxSupportedVCs OBJECT-TYPE
    SYNTAX   INTEGER
    ACCESS   read-write
    STATUS   mandatory
    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  bad-
       Value"
   ::= { frDlcmiEntry 9 }


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

```
-- 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.

--   Circuit Table

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

frCircuitTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF FrCircuitEntry
    ACCESS   not-accessible
    STATUS   mandatory
    DESCRIPTION
       "A table containing information about specific Data
       Link Connection Identifiers and corresponding virtual
       circuits."
    ::= { frame-relay 2 }

    frCircuitEntry OBJECT-TYPE
        SYNTAX   FrCircuitEntry
        ACCESS   not-accessible
        STATUS   mandatory
        DESCRIPTION
           "The information regarding a single  Data  Link
           Connection Identifier."
       INDEX { frCircuitIfIndex, frCircuitDlci }
       ::= { frCircuitTable 1 }


    FrCircuitEntry ::=
        SEQUENCE {
            frCircuitIfIndex
                Index,
            frCircuitDlci
                DLCI,
            frCircuitState
                INTEGER,
            frCircuitReceivedFECNs
                Counter,
            frCircuitReceivedBECNs
```

```
                Counter,
            frCircuitSentFrames
                Counter,
            frCircuitSentOctets
                Counter,
            frCircuitReceivedFrames
                Counter,
            frCircuitReceivedOctets
                Counter,
            frCircuitCreationTime
                TimeTicks,
            frCircuitLastTimeChange
                TimeTicks,
            frCircuitCommittedBurst
                INTEGER,
            frCircuitExcessBurst
                INTEGER,
            frCircuitThroughput
                INTEGER
        }


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


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

```
frCircuitState OBJECT-TYPE
    SYNTAX   INTEGER {
                invalid (1),
                active (2),
                inactive (3)
             }
    ACCESS   read-write
    STATUS   mandatory
    DESCRIPTION
       "Indicates whether the particular virtual  cir-
       cuit  is operational.  In the absence of a Data
       Link Connection Management  Interface,  virtual
       circuit  entries  (rows) may be created by set-
       ting 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."
   DEFVAL { active }
   ::= { frCircuitEntry 3 }


frCircuitReceivedFECNs OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "Number of frames received from the network in-
       dicating  forward  congestion since the virtual
       circuit was created."
   REFERENCE
      "Draft American National  Standard  T1.618-1991,
      Section 3.3.3"
  ::= { frCircuitEntry 4 }



frCircuitReceivedBECNs OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "Number of frames received from the network in-
       dicating  backward congestion since the virtual
       circuit was created."
```

```
            REFERENCE
               "Draft American National  Standard  T1.618-1991,
               Section 3.3.4"
            ::= { frCircuitEntry 5 }


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


        frCircuitSentOctets OBJECT-TYPE
            SYNTAX   Counter
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
               "The number of octets sent  from  this  virtual
               circuit since it was created."
           ::= { frCircuitEntry 7 }


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


        frCircuitReceivedOctets OBJECT-TYPE
            SYNTAX   Counter
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
               "Number of octets received  over  this  virtual
               circuit since it was created."
           ::= { frCircuitEntry 9 }
```

```
frCircuitCreationTime OBJECT-TYPE
    SYNTAX   TimeTicks
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "The value of sysUpTime when the  virtual  cir-
       cuit was created, whether by the Data Link Con-
       nection Management Interface  or  by  a  SetRe-
       quest."
   ::= { frCircuitEntry 10 }


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


frCircuitCommittedBurst OBJECT-TYPE
    SYNTAX   INTEGER
    ACCESS   read-write
    STATUS   mandatory
    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
      "Draft American National  Standard  T1.617-1991,
      Section 6.5.19"
  DEFVAL   { 0 }  -- the default indicates no commitment
  ::= { frCircuitEntry 12 }


frCircuitExcessBurst OBJECT-TYPE
    SYNTAX   INTEGER
    ACCESS   read-write
    STATUS   mandatory
    DESCRIPTION
       "This variable indicates the maximum amount  of
       uncommitted data bits that the network will at-
```

```
                tempt 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
               "Draft American National  Standard  T1.617-1991,
               Section 6.5.19"
                   ::= { frCircuitEntry 13 }



        frCircuitThroughput OBJECT-TYPE
            SYNTAX   INTEGER
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "Throughput is the average number of 'Frame Re-
               lay  Information  Field'  bits  transferred per
               second across a user network interface  in  one
               direction, measured over the measurement inter-
               val.

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

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


     --  Error Table

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

     frErrTable OBJECT-TYPE
         SYNTAX   SEQUENCE OF FrErrEntry
         ACCESS   not-accessible
```

```
        STATUS   mandatory
        DESCRIPTION
           "A table containing information about Errors on the
           Frame Relay interface."
        ::= { frame-relay 3 }

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



        FrErrEntry ::=
            SEQUENCE {
                frErrIfIndex
                    Index,
                frErrType
                    INTEGER,
                frErrData
                    OCTET STRING,
                frErrTime
                    TimeTicks
        }



        frErrIfIndex OBJECT-TYPE
            SYNTAX   Index
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
               "The ifIndex Value of the  corresponding  ifEn-
               try."
           ::= { frErrEntry 1 }



        frErrType OBJECT-TYPE
            SYNTAX   INTEGER {
                        unknownError(1),
                        receiveShort(2),
                        receiveLong(3),
```

```
                        illegalDLCI(4),
                        unknownDLCI(5),
                        dlcmiProtoErr(6),
                        dlcmiUnknownIE(7),
                        dlcmiSequenceErr(8),
                        dlcmiUnknownRpt(9),
                        noErrorSinceReset(10)
                    }
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
           "The type of error that was last seen  on  this
           interface."
       ::= { frErrEntry 2 }


    frErrData OBJECT-TYPE
        SYNTAX   OCTET STRING
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
           "An octet string containing as much of the  er-
           ror  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 in-
           formation up to the PDU."
       ::= { frErrEntry 3 }


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


    -- Frame Relay Globals

    frame-relay-globals OBJECT IDENTIFIER ::= { frame-relay 4 }

    frTrapState OBJECT-TYPE
        SYNTAX  INTEGER { enabled(1), disabled(2) }
        ACCESS   read-write
```

```
            STATUS   mandatory
            DESCRIPTION
               "This variable  indicates  whether  the  system
               produces the frDLCIStatusChange trap."
           DEFVAL { disabled }
           ::= { frame-relay-globals 1 }


        --  Data Link Connection Management Interface Related Traps

        frDLCIStatusChange TRAP-TYPE
            ENTERPRISE frame-relay
            VARIABLES  { frCircuitIfIndex, frCircuitDlci, frCircuitState }
            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."
            ::= 1

     END
```

5. Acknowledgements

This document was produced by the IP Over Large Public Data Networks (IPLPDN) Working Group.

The following people provided additional comments and suggestions: Art Berggreen of Advanced Computer Communications, and Jim Philippou of Xyplex Communications.

6. References

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7. Security Considerations

Security issues are not discussed in this memo.

8. Authors' Addresses

Caralyn Brown
Wellfleet Communications, Inc.
15 Crosby Drive
Bedford, Massachusetts 01730

Phone: (617) 275-2400
EMail: cbrown@wellfleet.com

Fred Baker
Advanced Computer Communications
315 Bollay Drive
Sannta Barbara, California 93117

Phone: (805) 685-4455
EMail: fbaker@acc.com

Charles Carvalho
Advanced Computer Communications
315 Bollay Drive
Sannta Barbara, California 93117

Phone: (805) 685-4455
EMail: charles@acc.com