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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.

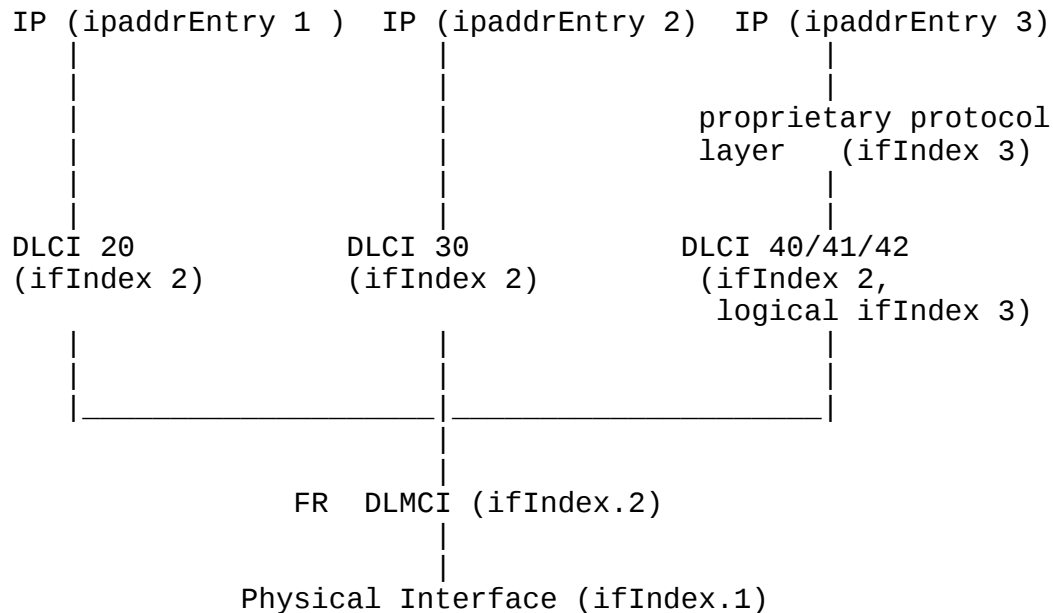
4. Overview

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:



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 ifType	As per DESCRIPTION in RFC 1573. 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` $\geq$ 155 Mbits/s.
See details for `ifInOctets`.

`ifHCOctets` Only required when `ifSpeed` $\geq$ 155 Mbits/s.
See details for `ifInOctets`.

`ifLinkUpDownTrapEnable` 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 identifier 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
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                Santa Barbara, California 93111
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        E-Mail: fred@cisco.com"
```

```
    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-TYPESYNTAX 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-TYPESYNTAX 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

$$T = \text{frCircuitCommittedBurst} / \text{frCircuitThroughput}.$$

If the configured committed burst rate and throughput are both zero, the measurement interval, T, is

$$T = \text{frCircuitExcessBurst} / \text{ifSpeed}."$$

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 Committee 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.

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

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

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

dlcmlUnknownRpt: 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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