        Definitions of Managed Objects for the DS1 and E1 Interface Types

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 DS1 Interfaces --
   including both T1 and E1 (a.k.a., CEPT 2 Mbit/s) links.

   This document entirely replaces RFC 1232, which contains a
   fundamental error: many objects are encoded as Counters that must be
   encoded as INTEGERs or Gauges. The magnitude of the change required
   is sufficient that virtually every object changed. Therefore, the
   MIB documented in RFC 1232 should not be implemented.

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1.   The Network Management Framework

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

         STD 16/RFC 1155 [1] which defines the SMI, the mechanisms used for
         describing and naming objects for the purpose of management. STD
         16/RFC 1212 [2] defines a more concise description mechanism,
         which is wholly consistent with the SMI.

         RFC 1156 [3] which defines MIB-I, the core set of managed objects
         for the Internet suite of protocols. STD 17/RFC 1213 [4] defines
         MIB-II, an evolution of MIB-I based on implementation experience
         and new operational requirements.

         STD 15/RFC 1157 [5] 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) [6]
     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 [1] 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 [7],
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 STD 16, RFC 1212 [2].

2.2. Changes from RFC 1232

   The changes from RFC 1232 are the following:

      (1)   This MIB module contains three groups: DS1 Near End Group
            which is mandatory, DS1 Far End Group which is optional,
            and the Fractional Table, which is optional.

      (2)   The Far End Group is a new group and contains statistics
            that are collected from the far end DS1 interface. The
            Far End Group may only be implemented by DS1 systems that
            use the facilities data link to exchange this information
            - both T1.403 and PUB 54016 define ways to exchange this
            information over data links; vendors may use other
            proprietary means to do this on various link types.

      (3)   ds1CSUIndex has been renamed dsx1LineIndex. This object
            is the identifier of a DS1 Interface on a device. On a
            CSU, a single DS1 data stream will cross two DS1
            interfaces, which have separate dsx1LineIndex values.

      (4)   ds1Index has been renamed dsx1IfIndex. This value for
            this object is equal to the value of ifIndex from the
            Interfaces table of MIB II (STD 17, RFC 1213).

      (5)   an object has been added (dsx1TransmitClockSource) to
            indicate the source of transmit clock.

(6)   The ACCESS for objects in the dsx1ConfigTable has been
      set to read-write for items that are configurable.

(7)   Description of test configurations has changed. A new
      object has been added called dsx1LoopbackConfig, which
      better describes the loopback capabilities of a DS1
      interface on a device.

(8)   The description of line alarm status has changed. A new
      object has been added called dsx1LineStatus. This object
      better describes the status (e.g., failure state and
      loopback state) of a DS1 interface.

(9)   All Counters have been changed to Gauges.

(10) Information about how applications might use the zero
      code suppression have been removed; only the actual line
      coding algorithm is described. For clarity the object
      was thus renamed to dsx1LineCoding.

(11) A Line Errored Seconds object has been added to all near
      end tables and the count of Bipolar Violations (BPVs) was
      changed to a count of Line Code Violations (LCVs).

(12) Bursty Errored Seconds (a.k.a., Errored Seconds Type B)
      and Degraded Minutes objects have been added to all near
      end tables.

(13) The Coding Violation error event is now referred to as a
      Path Coding Violation (PCV) Error Event.

3. Overview

   These objects are used when the particular media being used to
   realize an interface is a DS1 physical interface. At present, this
   applies to these values of the ifType variable in the Internet-
   standard MIB:

            ds1 (18)
            e1 (19)

   The definitions contained herein are based on the AT&T T-1 Superframe
   (a.k.a., D4) and Extended Superframe (ESF) formats [8, 9], the latter
   of which conforms to ANSI specifications [10], and the CCITT
   Recommendations [11, 12], referred to as E1 for the rest of this
   memo.

The various T1 and E1 line disciplines are similar enough that
separate MIBs are unwarranted, although there are some differences.
For example, Loss of Frame is defined more rigorously in the ESF
specification than in the D4 specification, but it is defined in
both.

Where it is necessary to distinguish between the flavors of E1 with
and without CRC, E1-CRC to denotes the "with CRC" form (G.704 Table
4b) and E1-noCRC denotes the "without CRC" form (G.704 Table 4a).

3.1. Binding between ifIndex and DS1 Interfaces

Different physical configurations for the support of SNMP with DS1
equipment exist. To accommodate these scenarios, two different
indices for DS1 interfaces are introduced in this MIB. These indices
are dsx1IfIndex and dsx1LineIndex.

External interface scenario: the SNMP Agent represents all managed
DS1 lines as external interfaces (for example, an Agent residing on
the device supporting DS1 interfaces directly):

For this scenario, all interfaces are assigned an integer value equal
to ifIndex, and the following applies:

       ifIndex=dsx1IfIndex=dsx1LineIndex for all interfaces.

The dsx1IfIndex column of the DS1 Configuration table relates each
DS1 interface to its corresponding interface (ifIndex) in the
Internet-standard MIB (MIB-II STD 17, RFC 1213).

External & Internal interface scenario: the SNMP Agents resides on an
host external from the device supporting DS1 interfaces (e.g., a
router). The Agent represents both the host and the DS1 device. The
index dsx1LineIndex is used to not only represent the DS1 interfaces
external from the host/DS1-device combination, but also the DS1
interfaces connecting the host and the DS1 device. The index
dsx1IfIndex is always equal to ifIndex.

Example:

A shelf full of CSUs connected to a Router. An SNMP Agent residing
on the router proxies for itself and the CSU. The router has also an
Ethernet interface:

```
            +-----+
        |   |     |
        |   |     |
        |   |     |       +---------------------+
        |E  |     |  1.544   MBPS |            Line#A | DS1 Link
        |t  |  R  |  -------------+ - - - - -  - - -  - +------>
        |h  |     |               |                   |
        |e  |  O  |  1.544   MBPS |            Line#B | DS1 Link
        |r  |     |  -------------+ - - - - - - - - - +------>
        |n  |  U  |               |  CSU Shelf        |
        |e  |     |  1.544   MBPS |            Line#C | DS1 Link
        |t  |  T  |  -------------+ - - - -- -- - - - - +------>
        |   |     |               |                   |
        |-----|  E  |  1.544   MBPS |            Line#D | DS1 Link
        |   |     |  -------------+ - - - - -- - - - - +------>
        |   |  R  |               |_____|
        |   |     |
        |   |     |
        |   +-----+
```
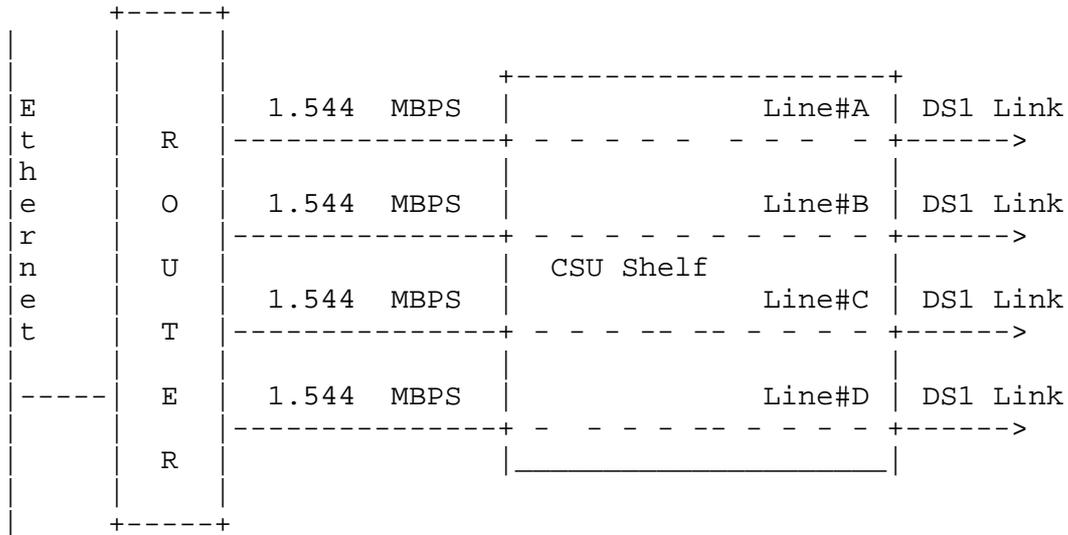
The assignment of the index values could for example be:

```
ifIndex (= dsx1IfIndex)                  dsx1LineIndex
1                   NA                       NA (Ethernet)
2       Line#A    Router Side        6
2       Line#A    Network Side       7
3       Line#B    Router Side        8
3       Line#B    Network Side       9
4       Line#C    Router Side        10
4       Line#C    Network Side       11
5       Line#D    Router Side        12
5       Line#D    Network Side       13
```

For this example, ifNumber is equal to 5. Note the following
description of dsx1LineIndex: the dsx1LineIndex identifies a DS1
Interface on a managed device. If there is an ifEntry that is
directly associated with this and only this DS1 interface, it should
have the same value as ifIndex. Otherwise, number the
dsx1LineIndices with an unique identifier following the rules of
choosing a number greater than ifNumber and numbering inside
interfaces (e.g., equipment side) with even numbers and outside
interfaces (e.g., network side) with odd numbers.

If the CSU shelf is managed by itself by a local SNMP Agent, the
situation would be:

```
       ifIndex (= dsx1IfIndex)                dsx1LineIndex
       2       Line#A      Router Side         2
       1       Line#A      Network Side        1
       4       Line#B      Router Side         4
       3       Line#B      Network Side        3
       6       Line#C      Router Side         6
       5       Line#C      Network Side        5
       8       Line#D      Router Side         8
       7       Line#D      Network Side        7
```

3.2. Objectives of this MIB Module

   There are numerous things that could be included in a MIB for DS1
   signals: the management of multiplexors, CSUs, DSUs, and the like.
   The intent of this document is to facilitate the common management of
   all devices with DS1 interfaces. As such, a design decision was made
   up front to very closely align the MIB with the set of objects that
   can generally be read from DS1 devices that are currently deployed.

3.3. DS1 Terminology

   The terminology used in this document to describe error conditions on
   a DS1 interface as monitored by a DS1 device are based on the
   definitions from the ANSI T1M1.3/92-005R1 draft standard [13]. If
   the definition in this document does not match the definition in the
   ANSI T1M1.3/92-005R1 draft document, the implementer should follow
   the definition described in this document.

3.3.1. Error Events

   Bipolar Violation (BPV) Error Event
        A BPV error event for an AMI-coded signal is the
        occurrence of a pulse of the same polarity as the
        previous pulse. A BPV error event for a B8ZS- or HDB3-
        coded signal is the occurrence of a pulse of the same
        polarity as the previous pulse without being a part of
        the zero substitution code.

   Excessive Zeroes (EXZ) Error Event
        An Excessive Zeroes error event for an AMI-coded signal
        is the occurrence of more than fifteen contiguous zeroes.
        For a B8ZS coded signal, the defect occurs when more than
        seven contiguous zeroes are detected.

   Line Coding Violation (LCV) Error Event
        A Line Coding Violation (LCV) is the occurrence of either
        a Bipolar Violation (BPV) or Excessive Zeroes (EXZ) Error
        Event.

Path Coding Violation (PCV) Error Event
     A Path Coding Violation error event is a frame
     synchronization bit error in the D4 and E1-noCRC formats,
     or a CRC error in the ESF and E1-CRC formats.

Controlled Slip (CS) Error Event
     A Controlled Slip is the replication or deletion of the
     payload bits of a DS1 frame. A Controlled Slip may be
     performed when there is a difference between the timing
     of a synchronous receiving terminal and the received
     signal. A Controlled Slip does not cause an Out of Frame
     defect.

3.3.2. Performance Defects

Out Of Frame (OOF) Defect
     An OOF defect is the occurrence of a particular density
     of Framing Error events.

     For T1 links, an Out of Frame defect is declared when the
     receiver detects two or more framing errors within a 3
     msec period for ESF signals and 0.75 msec for D4 signals,
     or two or more errors out of five or fewer consecutive
     framing-bits.

     For E1 links, an Out Of Frame defect is declared when
     three consecutive frame alignment signals have been
     received with an error (see G.706 Section 4.1 [17]).

     Once an Out Of Frame Defect is declared, the framer
     starts searching for a correct framing pattern. The Out
     of Frame defect ends when the signal is in frame.

     In-frame occurs when there are fewer than two frame bit
     errors within 3 msec period for ESF signals and 0.75 msec
     for D4 signals.

     For E1 links, in-frame occurs when a) in frame N the
     frame alignment signal is correct and b) in frame N+1 the
     frame alignment signal is absent (i.e., bit 2 in TS0 is a
     one) and c) in frame N+2 the frame alignment signal is
     present and correct.

Alarm Indication Signal (AIS) Defect
     For D4 and ESF links, the 'all ones' condition is
     detected at a DS1 line interface upon observing an
     unframed signal with a one's density of at least 99.9%
     present for a time equal to or greater than T, where 3 ms

          <= T <= 75 ms. The AIS is terminated upon observing a
          signal not meeting the one's density or the unframed
          signal criteria for a period equal to or greater than
          than T.

          For E1 links, the 'all-ones' condition is detected at the
          line interface as a string of 512 bits containing fewer
          than three zero bits (see O.162 [14] Section 3.3.2).

3.3.3. Performance Parameters

     All performance parameters are accumulated in fifteen minute
     intervals and up to 96 intervals (24 hours worth) are kept by an
     agent. Fewer than 96 intervals of data will be available if the
     agent has been restarted within the last 24 hours. In addition,
     there is a rolling 24-hour total of each performance parameter.

     There is no requirement for an agent to ensure fixed relationship
     between the start of a fifteen minute interval and any wall clock;
     however some agents may align the fifteen minute intervals with
     quarter hours.

        Line Errored Seconds (LES)
             A Line Errored Second, according to T1M1.3, is a second
             in which one or more Line Code Violation error events
             were detected.

             While many implementations are currently unable to detect
             the zero strings, it is expected that interface
             manufacturers will add this capability in deference to
             ANSI; therefore, it will become available in time.

             In the T1M1.3 specification, near end Line Code
             Violations and far end Line Errored Seconds are counted.
             For consistency, we count Line Errored Seconds at both
             ends.

        Controlled Slip Seconds (CSS)
             A Controlled Slip Second is a one-second interval
             containing one or more controlled slips.

        Errored Seconds (ES)
             For ESF and E1-CRC links an Errored Second is a second
             with one or more Path Code Violations OR one or more Out
             of Frame defects OR one or more Controlled Slip events OR
             a detected AIS defect.

             For D4 and E1-noCRC links, the presence of Bipolar

Violations also triggers an Errored Second.

This is not incremented during an Unavailable Second.

Bursty Errored Seconds (BES)
     A Bursty Errored Second (also known as Errored Second
     type B) is a second with fewer than 320 and more than 1
     Path Coding Violation error events, no Severely Errored
     Frame defects and no detected incoming AIS defects.
     Controlled slips are not included in this parameter.

     This is not incremented during an Unavailable Second.

Severely Errored Seconds (SES)
     A Severely Errored Second for ESF signals is a second
     with 320 or more Path Code Violation Error Events OR one
     or more Out of Frame defects OR a detected AIS defect.

     For E1-CRC signals, a Severely Errored Second is a second
     with 832 or more Path Code Violation error events OR one
     or more Out of Frame defects.

     For E1-noCRC signals, a Severely Errored Second is a 2048
     LCVs or more.

     For D4 signals, a Severely Errored Second is a count of
     one-second intervals with Framing Error events, or an OOF
     defect, or 1544 LCVs or more.

     Controlled slips are not included in this parameter.

     This is not incremented during an Unavailable Second.

Severely Errored Framing Second (SEFS)
     An Severely Errored Framing Second is a second with one
     or more Out of Frame defects OR a detected AIS defect.

Degraded Minutes
     A Degraded Minute is one in which the estimated error
     rate exceeds 1E-6 but does not exceed 1E-3 (see G.821
     [15]).

     Degraded Minutes are determined by collecting all of the
     Available Seconds, removing any Severely Errored Seconds
     grouping the result in 60-second long groups and counting
     a 60-second long group (a.k.a., minute) as degraded if the
     cumulative errors during the seconds present in the group
     exceed 1E-6. Available seconds are merely those seconds

which are not Unavailable as described below.

   Unavailable Seconds (UAS)
         Unavailable Seconds (UAS) are calculated by counting the
         number of seconds that the interface is unavailable. The
         DS1 interface is said to be unavailable from the onset of
         10 contiguous SESs, or the onset of the condition leading
         to a failure (see Failure States). If the condition
         leading to the failure was immediately preceded by one or
         more contiguous SESs, then the DS1 interface
         unavailability starts from the onset of these SESs. Once
         unavailable, and if no failure is present, the DS1
         interface becomes available at the onset of 10 contiguous
         seconds with no SESs. Once unavailable, and if a failure
         is present, the DS1 interface becomes available at the
         onset of 10 contiguous seconds with no SESs, if the
         failure clearing time is less than or equal to 10
         seconds. If the failure clearing time is more than 10
         seconds, the DS1 interface becomes available at the onset
         of 10 contiguous seconds with no SESs, or the onset
         period leading to the successful clearing condition,
         whichever occurs later. With respect to the DS1 error
         counts, all counters are incremented while the DS1
         interface is deemed available. While the interface is
         deemed unavailable, the only count that is incremented is
         UASs.

         A special case exists when the 10 or more second period
         crosses the 900 second statistics window boundary, as the
         foregoing description implies that the Severely Errored
         Second and Unavailable Second counters must be adjusted
         when the Unavailable Signal State is entered. Clearly,
         successive GETs of the affected dsx1IntervalSESs and
         dsx1IntervalUASs objects will return differing values if
         the first GET occurs during the first few seconds of the
         window. This is viewed as an unavoidable side-effect of
         selecting the presently defined managed objects as a
         basis for this memo.

3.3.4. Failure States

   The following failure states are received, or detected failures, that
   are reported in the dsx1LineStatus object. When a DS1 interface
   would, if ever, produce the conditions leading to the failure state
   is described in the appropriate specification.

Far End Alarm Failure
      The Far End Alarm failure is also known as "Yellow Alarm"
      in the T1 case and "Distant Alarm" in the E1 case.

      For D4 links, the Far End Alarm failure is declared when
      bit 6 of all channels has been zero for at least 335 ms
      and is cleared when bit 6 of at least one channel is
      non-zero for a period T, where T is usually less than one
      second and always less than 5 seconds. The Far End Alarm
      failure is not declared for D4 links when a Loss of
      Signal is detected.

      For ESF links, the Far End Alarm failure is declared if
      the Yellow Alarm signal pattern occurs in at least seven
      out of ten contiguous 16-bit pattern intervals and is
      cleared if the Yellow Alarm signal pattern does not occur
      in ten contiguous 16-bit signal pattern intervals.

      For E1 links, the Far End Alarm failure is declared when
      bit 3 of time-slot zero is received set to one on two
      consecutive occasions. The Far End Alarm failure is
      cleared when bit 3 of time-slot zero is received set to
      zero.

Alarm Indication Signal (AIS) Failure
      The Alarm Indication Signal failure is declared when an
      AIS defect is detected at the input and the AIS defect
      still exists after the Loss Of Frame failure (which is
      caused by the unframed nature of the 'all-ones' signal)
      is declared. The AIS failure is cleared when the Loss Of
      Frame failure is cleared.

Loss Of Frame Failure
      For T1 links, the Loss Of Frame failure is declared when
      an OOF or LOS defect has persisted for T seconds, where
      2 <= T <= 10. The Loss Of Frame failure is cleared when
      there have been no OOF or LOS defects during a period T
      where 0 <= T <= 20. Many systems will perform "hit
      integration" within the period T before declaring or
      clearing the failure e.g., see TR 62411 [16].

      For E1 links, the Loss Of Frame Failure is declared when
      an OOF defect is detected.

Loss Of Signal Failure
      For T1, the Loss Of Signal failure is declared upon
      observing 175 +/- 75 contiguous pulse positions with no
      pulses of either positive or negative polarity. The LOS

          failure is cleared upon observing an average pulse
          density of at least 12.5% over a period of 175 +/- 75
          contiguous pulse positions starting with the receipt of a
          pulse.

          For E1 links, the Loss Of Signal failure is declared when
          greater than 10 consecutive zeroes are detected (see
          O.162 Section 3.4.4).

     Loopback Pseudo-Failure
          The Loopback Pseudo-Failure is declared when the near end
          equipment has placed a loopback (of any kind) on the DS1.
          This allows a management entity to determine from one
          object whether the DS1 can be considered to be in service
          or not (from the point of view of the near end
          equipment).

     TS16 Alarm Indication Signal Failure
          For E1 links, the TS16 Alarm Indication Signal failure is
          declared when time-slot 16 is received as all ones for
          all frames of two consecutive multiframes (see G.732
          Section 4.2.6). This condition is never declared for T1.

     Loss Of MultiFrame Failure
          The Loss Of MultiFrame failure is declared when two
          consecutive multiframe alignment signals (bits 4 through
          7 of TS16 of frame 0) have been received with an error.
          The Loss Of Multiframe failure is cleared when the first
          correct multiframe alignment signal is received. The
          Loss Of Multiframe failure can only be declared for E1
          links operating with G.732 [18] framing (sometimes called
          "Channel Associated Signalling" mode).

     Far End Loss Of Multiframe Failure
          The Far End Loss Of Multiframe failure is declared when
          bit 2 of TS16 of frame 0 is received set to one on two
          consecutive occasions. The Far End Loss Of Multiframe
          failure is cleared when bit 2 of TS16 of frame 0 is
          received set to zero. The Far End Loss Of Multiframe
          failure can only be declared for E1 links operating in
          "Channel Associated Signalling" mode.

3.3.5. Other Terms

     Circuit Identifier
          This is a character string specified by the circuit
          vendor, and is useful when communicating with the vendor
          during the troubleshooting process.

4. Definitions

     RFC1406-MIB DEFINITIONS ::= BEGIN
     IMPORTS
             Gauge
                     FROM RFC1155-SMI
             transmission, DisplayString
                     FROM RFC1213-MIB
             OBJECT-TYPE
                     FROM RFC-1212;

     --   This MIB module uses the extended OBJECT-TYPE macro as
     --   defined in RFC 1212.

     --   this is the MIB module for the DS1 objects

     ds1 OBJECT IDENTIFIER ::= { transmission 18 }

     -- note that this subsumes cept (19); there is no separate CEPT MIB

     -- The DS1 Near End Group

     -- Implementation of this group is mandatory for all systems
     -- that attach to a DS1 Interface.

     -- The DS1 Near End Group consists of four tables:
     --   DS1 Configuration
     --   DS1 Current
     --   DS1 Interval
     --   DS1 Total

     -- the DS1 Configuration Table

        dsx1ConfigTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dsx1ConfigEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
               "The DS1 Configuration table."
           ::= { ds1 6 }

        dsx1ConfigEntry OBJECT-TYPE
            SYNTAX   Dsx1ConfigEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION

```
                    "An entry in the DS1 Configuration table."
                INDEX   { dsx1LineIndex }
                ::= { dsx1ConfigTable 1 }

        Dsx1ConfigEntry ::=
            SEQUENCE {
                dsx1LineIndex
                    INTEGER,
                dsx1IfIndex
                    INTEGER,
                dsx1TimeElapsed
                    INTEGER,
                dsx1ValidIntervals
                    INTEGER,
                dsx1LineType
                    INTEGER,
                dsx1LineCoding
                    INTEGER,
                dsx1SendCode
                    INTEGER,
                dsx1CircuitIdentifier
                    DisplayString,
                dsx1LoopbackConfig
                    INTEGER,
                dsx1LineStatus
                    INTEGER,
                dsx1SignalMode
                    INTEGER,
                dsx1TransmitClockSource
                    INTEGER,
                dsx1Fdl
                    INTEGER
            }

        dsx1LineIndex OBJECT-TYPE
            SYNTAX  INTEGER (1..'7fffffff'h)
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                "This object is the identifier of a DS1  Inter-
                face on a managed device.  If there is an ifEn-
                try that is directly associated with  this  and
                only  this  DS1 interface, it should have the
                same value as ifIndex.  Otherwise,  the  value
                exceeds  ifNumber,  and  is a unique identifier
                following this rule: inside  interfaces  (e.g.,
                equipment  side)  with even numbers and outside
                interfaces  (e.g.,  network  side)   with   odd
```

```
            numbers."
        ::= { dsx1ConfigEntry 1 }


    dsx1IfIndex OBJECT-TYPE
        SYNTAX   INTEGER (1..'7fffffff'h)
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
            "This value for this object  is  equal  to  the
            value  of  ifIndex from the Interfaces table of
            MIB II (RFC 1213)."
        ::= { dsx1ConfigEntry 2 }


    dsx1TimeElapsed OBJECT-TYPE
        SYNTAX   INTEGER (0..899)
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
            "The number of seconds that have elapsed  since
            the  beginning of the current error-measurement
            period."
        ::= { dsx1ConfigEntry 3 }


    dsx1ValidIntervals OBJECT-TYPE
        SYNTAX   INTEGER (0..96)
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
            "The number of  previous  intervals  for  which
            valid data was collected.  The value will be 96
            unless the interface was brought on-line within
            the last 24 hours, in which case the value will
            be the number of complete 15  minute  intervals
            the since interface has been online."
        ::= { dsx1ConfigEntry 4 }


    dsx1LineType OBJECT-TYPE
        SYNTAX   INTEGER {
                    other(1),
                    dsx1ESF(2),
                    dsx1D4(3),
                    dsx1E1(4),
                    dsx1E1-CRC(5),
                    dsx1E1-MF(6),
```

```
                  dsx1E1-CRC-MF(7)
            }
        ACCESS  read-write
        STATUS  mandatory
        DESCRIPTION
           "This variable indicates  the  variety  of  DS1
           Line  implementing  this  circuit.  The type of
           circuit affects the number of bits  per  second
           that  the circuit can reasonably carry, as well
           as the interpretation of the  usage  and  error
           statistics.  The values, in sequence, describe:

           TITLE:          SPECIFICATION:
           dsx1ESF         Extended SuperFrame DS1
           dsx1D4          AT&T D4 format DS1
           dsx1E1          CCITT Recommendation G.704
                              (Table 4a)
           dsx1E1-CRC      CCITT Recommendation G.704
                              (Table 4b)
           dsxE1-MF        G.704 (Table 4a) with TS16
                              multiframing enabled
           dsx1E1-CRC-MF G.704 (Table 4b) with TS16
                              multiframing enabled"

              ::= { dsx1ConfigEntry 5 }


    dsx1LineCoding OBJECT-TYPE
        SYNTAX  INTEGER {
                  dsx1JBZS (1),
                  dsx1B8ZS (2),
                  dsx1HDB3 (3),
                  dsx1ZBTSI (4),
                  dsx1AMI (5),
                  other(6)
            }
        ACCESS  read-write
        STATUS  mandatory
        DESCRIPTION
           "This variable describes the  variety  of  Zero
           Code  Suppression  used  on  the link, which in
           turn affects a number of its characteristics.

           dsx1JBZS refers the Jammed  Bit  Zero  Suppres-
           sion,  in  which  the  AT&T specification of at
           least one pulse every 8 bit periods is literal-
           ly  implemented  by forcing a pulse in bit 8 of
           each channel.  Thus, only seven bits per  chan-
```

nel, or 1.344 Mbps, is available for data.

dsx1B8ZS refers to the use of a specified pat-
tern of normal bits and bipolar violations
which are used to replace a sequence of eight
zero bits.

ANSI Clear Channels may use dsx1ZBTSI, or Zero
Byte Time Slot Interchange.

E1 links, with or without CRC, use dsx1HDB3 or
dsx1AMI.

dsx1AMI refers to a mode wherein no zero code
suppression is present and the line encoding
does not solve the problem directly. In this
application, the higher layer must provide data
which meets or exceeds the pulse density re-
quirements, such as inverting HDLC data."
    ::= { dsx1ConfigEntry 6 }

    dsx1SendCode OBJECT-TYPE
        SYNTAX INTEGER {
                    dsx1SendNoCode(1),
                    dsx1SendLineCode(2),
                    dsx1SendPayloadCode(3),
                    dsx1SendResetCode(4),
                    dsx1SendQRS(5),
                    dsx1Send511Pattern(6),
                    dsx1Send3in24Pattern(7),
                    dsx1SendOtherTestPattern(8)
                }
        ACCESS read-write
        STATUS mandatory
        DESCRIPTION
            "This variable indicates what type of code is
            being sent across the DS1 interface by the dev-
            ice. The values mean:

            dsx1SendNoCode
                 sending looped or normal data

            dsx1SendLineCode
                 sending a request for a line loopback

            dsx1SendPayloadCode
                 sending a request for a payload loopback

        dsx1SendResetCode
             sending a loopback termination request

        dsx1SendQRS
             sending a Quasi-Random Signal (QRS) test
             pattern

        dsx1Send511Pattern
             sending a 511 bit fixed test pattern

        dsx1Send3in24Pattern
             sending a fixed test pattern of 3 bits set
             in 24

        dsx1SendOtherTestPattern
             sending a test pattern other than those
             described by this object"
     ::= { dsx1ConfigEntry 7 }

    dsx1CircuitIdentifier OBJECT-TYPE
        SYNTAX DisplayString (SIZE (0..255))
        ACCESS read-write
        STATUS mandatory
        DESCRIPTION
           "This variable   contains   the   transmission
           vendor's circuit identifier, for the purpose of
           facilitating troubleshooting."
     ::= { dsx1ConfigEntry 8 }

    dsx1LoopbackConfig OBJECT-TYPE
        SYNTAX   INTEGER {
                  dsx1NoLoop(1),
                  dsx1PayloadLoop(2),
                  dsx1LineLoop(3),
                  dsx1OtherLoop(4)
                }
        ACCESS read-write
        STATUS mandatory
        DESCRIPTION
           "This variable represents the loopback confi-
           guration of the DS1 interface. Agents support-
           ing read/write access should return badValue in
           response to a requested loopback state that the
           interface does not support. The values mean:

dsx1NoLoop
        Not in the loopback state. A device that
        is not capable of performing a loopback on
        the interface shall always return this as
        it's value.

dsx1PayloadLoop
        The received signal at this interface is
        looped through the device. Typically the
        received signal is looped back for re-
        transmission after it has passed through
        the device's framing function.

dsx1LineLoop
        The received signal at this interface does
        not go through the device (minimum pene-
        tration) but is looped back out.

dsx1OtherLoop
        Loopbacks that are not defined here."
    ::= { dsx1ConfigEntry 9 }

dsx1LineStatus OBJECT-TYPE
    SYNTAX INTEGER (1..8191)
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "This variable indicates the Line Status of the
        interface. It contains loopback, failure, re-
        ceived 'alarm' and transmitted 'alarm' infor-
        mation.

The dsx1LineStatus is a bit map represented as a sum,
therefore, it can represent multiple failures (alarms) and
a LoopbackState simultaneously.

dsx1NoAlarm should be set if and only if no other flag is
set.

If the dsx1LoopbackState bit is set, the loopback in ef-
fect can be determined from the dsx1LoopbackConfig object.

The various bit positions are:
    1   dsx1NoAlarm   No Alarm Present
    2   dsx1RcvFarEndLOF   Far end LOF (a.k.a., Yellow Alarm)
    4   dsx1XmtFarEndLOF   Near end sending LOF Indication
    8   dsx1RcvAIS   Far end sending AIS

```
         16      dsx1XmtAIS              Near end sending AIS
         32      dsx1LossOfFrame         Near end LOF (a.k.a., Red Alarm)
         64      dsx1LossOfSignal        Near end Loss Of Signal
        128      dsx1LoopbackState       Near end is looped
        256      dsx1T16AIS              E1 TS16 AIS
        512      dsx1RcvFarEndLOMF       Far End Sending TS16 LOMF
       1024      dsx1XmtFarEndLOMF       Near End Sending TS16 LOMF
       2048      dsx1RcvTestCode         Near End detects a test code
       4096      dsx1OtherFailure        any line status not defined here"
          ::= { dsx1ConfigEntry 10 }


      dsx1SignalMode OBJECT-TYPE
          SYNTAX  INTEGER {
                      none (1),
                      robbedBit (2),
                      bitOriented (3),
                      messageOriented (4)
                  }
          ACCESS  read-write
          STATUS  mandatory
          DESCRIPTION
             "'none' indicates that no bits are reserved for
             signaling on this channel.

              'robbedBit' indicates that T1 Robbed Bit  Sig-
             naling is in use.

              'bitOriented' indicates that E1 Channel  Asso-
             ciated Signaling is in use.

              'messageOriented' indicates that Common  Chan-
             nel Signaling is in use either on channel 16 of
             an E1 link or channel 24 of a T1."
          ::= { dsx1ConfigEntry 11 }


      dsx1TransmitClockSource OBJECT-TYPE
          SYNTAX  INTEGER {
                      loopTiming (1),
                      localTiming (2),
                      throughTiming (3)
                  }
          ACCESS  read-write
          STATUS  mandatory
          DESCRIPTION
             "The source of Tranmit Clock.
```

                'loopTiming' indicates that the recovered re-
             ceive clock is used as the transmit clock.

                'localTiming' indicates that a local clock
             source is used.

                'throughTiming' indicates that recovered re-
             ceive clock from another interface is used as
             the transmit clock."
          ::= { dsx1ConfigEntry 12 }

        dsx1Fdl OBJECT-TYPE
            SYNTAX   INTEGER {
                        other(1),
                        dsx1Ansi-T1-403(2),
                        dsx1Att-54016(4),
                        dsx1Fdl-none(8)
                    }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This bitmap describes the use of the facili-
               ties data link, and is the sum of the capabili-
               ties:

                'other' indicates that a protocol other than
               one following is used.

                'dsx1Ansi-T1-403' refers to the FDL exchange
               recommended by ANSI.

                'dsx1Att-54016' refers to ESF FDL exchanges.

                'dsx1Fdl-none' indicates that the device does
               not use the FDL."
          ::= { dsx1ConfigEntry 13 }

    -- the DS1 Current Table

    -- The DS1 current table contains various statistics being
    -- collected for the current 15 minute interval.

        dsx1CurrentTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dsx1CurrentEntry
            ACCESS   not-accessible
            STATUS   mandatory

```
        DESCRIPTION
            "The DS1 Current table."
        ::= { ds1 7 }


    dsx1CurrentEntry OBJECT-TYPE
        SYNTAX  Dsx1CurrentEntry
        ACCESS  not-accessible
        STATUS  mandatory
        DESCRIPTION
            "An entry in the DS1 Current table."
        INDEX   { dsx1CurrentIndex }
        ::= { dsx1CurrentTable 1 }

 Dsx1CurrentEntry ::=
        SEQUENCE {
            dsx1CurrentIndex
                INTEGER,
            dsx1CurrentESs
                Gauge,
            dsx1CurrentSESs
                Gauge,
            dsx1CurrentSEFSs
                Gauge,
            dsx1CurrentUASs
                Gauge,
            dsx1CurrentCSSs
                Gauge,
            dsx1CurrentPCVs
                Gauge,
            dsx1CurrentLESs
                Gauge,
            dsx1CurrentBESs
                Gauge,
            dsx1CurrentDMs
                Gauge,
            dsx1CurrentLCVs
                Gauge
        }

    dsx1CurrentIndex OBJECT-TYPE
        SYNTAX  INTEGER (1..'7fffffff'h)
        ACCESS  read-only
        STATUS  mandatory
        DESCRIPTION
            "The index value which uniquely identifies  the
            DS1  interface  to which this entry is applica-
            ble.  The interface identified by a  particular
```

```
        value  of  this  index is the same interface as
        identified by the same value as a dsx1LineIndex
        object instance."
    ::= { dsx1CurrentEntry 1 }


  dsx1CurrentESs OBJECT-TYPE
     SYNTAX   Gauge
     ACCESS   read-only
     STATUS   mandatory
     DESCRIPTION
        "The number of Errored Seconds, encountered  by
        a DS1 interface in the current 15 minute inter-
        val."
    ::= { dsx1CurrentEntry 2 }


  dsx1CurrentSESs OBJECT-TYPE
     SYNTAX   Gauge
     ACCESS   read-only
     STATUS   mandatory
     DESCRIPTION
        "The number of Severely Errored Seconds encoun-
        tered  by  a  DS1  interface  in the current 15
        minute interval."
    ::= { dsx1CurrentEntry 3 }


  dsx1CurrentSEFSs OBJECT-TYPE
     SYNTAX   Gauge
     ACCESS   read-only
     STATUS   mandatory
     DESCRIPTION
        "The number of Severely Errored Framing Seconds
        encountered  by  a DS1 interface in the current
        15 minute interval."
    ::= { dsx1CurrentEntry 4 }


  dsx1CurrentUASs OBJECT-TYPE
     SYNTAX   Gauge
     ACCESS   read-only
     STATUS   mandatory
     DESCRIPTION
        "The number of Unavailable Seconds  encountered
        by a DS1 interface in the current 15 minute in-
        terval."
    ::= { dsx1CurrentEntry 5 }
```

```
        dsx1CurrentCSSs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
              "The number of Controlled Slip Seconds  encoun-
              tered  by  a  DS1  interface  in the current 15
              minute interval."
         ::= { dsx1CurrentEntry 6 }


        dsx1CurrentPCVs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
              "The number of Path Coding  Violations  encoun-
              tered  by  a  DS1  interface  in the current 15
              minute interval."
         ::= { dsx1CurrentEntry 7 }


        dsx1CurrentLESs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
              "The number of Line Errored Seconds encountered
              by a DS1 interface in the current 15 minute in-
              terval."
         ::= { dsx1CurrentEntry 8 }


        dsx1CurrentBESs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
              "The number of Bursty  Errored  Seconds  (BESs)
              encountered  by  a DS1 interface in the current
              15 minute interval."
         ::= {dsx1CurrentEntry 9 }


        dsx1CurrentDMs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
```

```
                 DESCRIPTION
                     "The number of Degraded Minutes  (DMs)  encoun-
                      tered  by  a  DS1  interface  in the current 15
                      minute interval."
                  ::= { dsx1CurrentEntry 10 }


            dsx1CurrentLCVs OBJECT-TYPE
                 SYNTAX Gauge
                 ACCESS read-only
                 STATUS mandatory
                 DESCRIPTION
                     "The number of Line Code Violations (LCVs)  en-
                      countered  by a DS1 interface in the current 15
                      minute interval."
                  ::= {dsx1CurrentEntry 11 }



       -- the DS1 Interval

       -- The DS1 Interval Table contains various statistics
       -- collected by each DS1 Interface over the previous 24 hours of
       -- operation.  The past 24 hours are broken into 96 completed
       -- 15 minute intervals.

            dsx1IntervalTable OBJECT-TYPE
                 SYNTAX  SEQUENCE OF Dsx1IntervalEntry
                 ACCESS  not-accessible
                 STATUS  mandatory
                 DESCRIPTION
                     "The DS1 Interval table."
                  ::= { ds1 8 }


            dsx1IntervalEntry OBJECT-TYPE
                 SYNTAX  Dsx1IntervalEntry
                 ACCESS  not-accessible
                 STATUS  mandatory
                 DESCRIPTION
                     "An entry in the DS1 Interval table."
                 INDEX   { dsx1IntervalIndex, dsx1IntervalNumber }
                  ::= { dsx1IntervalTable 1 }

        Dsx1IntervalEntry ::=
            SEQUENCE {
                dsx1IntervalIndex
                    INTEGER,
                dsx1IntervalNumber
```

```
                          INTEGER,
                  dsx1IntervalESs
                     Gauge,
                  dsx1IntervalSESs
                     Gauge,
                  dsx1IntervalSEFSs
                     Gauge,
                  dsx1IntervalUASs
                     Gauge,
                  dsx1IntervalCSSs
                     Gauge,
                  dsx1IntervalPCVs
                     Gauge,
                  dsx1IntervalLESs
                     Gauge,
                  dsx1IntervalBESs
                     Gauge,
                  dsx1IntervalDMs
                     Gauge,
                  dsx1IntervalLCVs
                     Gauge
             }

         dsx1IntervalIndex OBJECT-TYPE
             SYNTAX  INTEGER (1..'7fffffff'h)
             ACCESS  read-only
             STATUS  mandatory
             DESCRIPTION
                "The index value which uniquely identifies  the
                DS1  interface  to which this entry is applica-
                ble.  The interface identified by a  particular
                value  of  this  index is the same interface as
                identified by the same value as a dsx1LineIndex
                object instance."
            ::= { dsx1IntervalEntry 1 }


         dsx1IntervalNumber OBJECT-TYPE
             SYNTAX  INTEGER (1..96)
             ACCESS  read-only
             STATUS  mandatory
             DESCRIPTION
                "A number between 1 and 96, where 1 is the most
                recently completed 15 minute interval and 96 is
                the least recently completed 15 minutes  inter-
                val  (assuming  that  all  96 intervals  are
                valid)."
            ::= { dsx1IntervalEntry 2 }
```

```
        dsx1IntervalESs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Errored Seconds encountered by a
               DS1  interface in one of the previous 96, indi-
               vidual 15 minute, intervals."
           ::= { dsx1IntervalEntry 3 }


        dsx1IntervalSESs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Severely Errored Seconds encoun-
               tered by a DS1 interface in one of the previous
               96, individual 15 minute, intervals."
           ::= { dsx1IntervalEntry 4 }


        dsx1IntervalSEFSs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Severely Errored Framing Seconds
               encountered  by  a  DS1 interface in one of the
               previous 96, individual 15 minute, intervals."
           ::= { dsx1IntervalEntry 5 }


        dsx1IntervalUASs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Unavailable Seconds  encountered
               by  a  DS1 interface in one of the previous 96,
               individual 15 minute, intervals."
           ::= { dsx1IntervalEntry 6 }


        dsx1IntervalCSSs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
```

```
                DESCRIPTION
                    "The number of Controlled Slip Seconds  encoun-
                    tered by a DS1 interface in one of the previous
                    96, individual 15 minute, intervals."
                ::= { dsx1IntervalEntry 7 }


        dsx1IntervalPCVs OBJECT-TYPE
                SYNTAX  Gauge
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                    "The number of Path Coding  Violations  encoun-
                    tered by a DS1 interface in one of the previous
                    96, individual 15 minute, intervals."
                ::= { dsx1IntervalEntry 8 }


        dsx1IntervalLESs OBJECT-TYPE
                SYNTAX  Gauge
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                    "The number of Line Errored Seconds encountered
                    by  a  DS1 interface in one of the previous 96,
                    individual 15 minute, intervals."
                ::= { dsx1IntervalEntry 9 }


        dsx1IntervalBESs OBJECT-TYPE
                SYNTAX Gauge
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                    "The number of Bursty  Errored  Seconds  (BESs)
                    encountered  by  a  DS1 interface in one of the
                    previous 96, individual 15 minute, intervals."
                ::= {dsx1IntervalEntry 10 }


        dsx1IntervalDMs OBJECT-TYPE
                SYNTAX Gauge
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                    "The number of Degraded Minutes  (DMs)  encoun-
                    tered by a DS1 interface in one of the previous
                    96, individual 15 minute, intervals."
```

```
                ::= { dsx1IntervalEntry 11 }


          dsx1IntervalLCVs OBJECT-TYPE
              SYNTAX Gauge
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
                  "The number of Line Code Violations (LCVs)  en-
                  countered  by a DS1 interface in the current 15
                  minute interval."
           ::= {dsx1IntervalEntry 12 }


      -- the DS1 Total

      -- The DS1 Total Table contains the cumulative sum of the
      -- various statistics for the 24 hour period preceding the
      -- current interval.

          dsx1TotalTable OBJECT-TYPE
              SYNTAX  SEQUENCE OF Dsx1TotalEntry
              ACCESS  not-accessible
              STATUS  mandatory
              DESCRIPTION
                  "The DS1 Total table.  24 hour interval."
              ::= { ds1 9 }


          dsx1TotalEntry OBJECT-TYPE
              SYNTAX  Dsx1TotalEntry
              ACCESS  not-accessible
              STATUS  mandatory
              DESCRIPTION
                  "An entry in the DS1 Total table."
              INDEX   { dsx1TotalIndex }
              ::= { dsx1TotalTable 1 }

      Dsx1TotalEntry ::=
          SEQUENCE {
              dsx1TotalIndex
                  INTEGER,
              dsx1TotalESs
                  Gauge,
              dsx1TotalSESs
                  Gauge,
              dsx1TotalSEFSs
                  Gauge,
```

```
             dsx1TotalUASs
                 Gauge,
             dsx1TotalCSSs
                 Gauge,
             dsx1TotalPCVs
                 Gauge,
             dsx1TotalLESs
                 Gauge,
             dsx1TotalBESs
                 Gauge,
             dsx1TotalDMs
                 Gauge,
             dsx1TotalLCVs
                 Gauge
         }

         dsx1TotalIndex OBJECT-TYPE
             SYNTAX   INTEGER (1..'7fffffff'h)
             ACCESS   read-only
             STATUS   mandatory
             DESCRIPTION
                "The index value which uniquely identifies  the
                DS1  interface  to which this entry is applica-
                ble.  The interface identified by a  particular
                value  of  this  index is the same interface as
                identified by the same value as a dsx1LineIndex
                object instance."
            ::= { dsx1TotalEntry 1 }


         dsx1TotalESs OBJECT-TYPE
             SYNTAX  Gauge
             ACCESS   read-only
             STATUS   mandatory
             DESCRIPTION
                "The number of Errored Seconds encountered by a
                DS1 interface in the previous 24 hour interval"
            ::= { dsx1TotalEntry 2 }


         dsx1TotalSESs OBJECT-TYPE
             SYNTAX  Gauge
             ACCESS   read-only
             STATUS   mandatory
             DESCRIPTION
                "The number of Severely Errored Seconds encoun-
                tered  by  a  DS1  interface in the previous 24
                hour interval."
```

        ::= { dsx1TotalEntry 3 }

        dsx1TotalSEFSs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Severely Errored Framing Seconds
                encountered by a DS1 interface in the previous
                24 hour interval."
        ::= { dsx1TotalEntry 4 }

        dsx1TotalUASs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Unavailable Seconds encountered
                by a DS1 interface in the previous 24 hour in-
                terval."
        ::= { dsx1TotalEntry 5 }

        dsx1TotalCSSs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Controlled Slip Seconds encoun-
                tered by a DS1 interface in the previous 24
                hour interval."
        ::= { dsx1TotalEntry 6 }

        dsx1TotalPCVs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Path Coding Violations encoun-
                tered by a DS1 interface in the previous 24
                hour interval."
        ::= { dsx1TotalEntry 7 }

```
        dsx1TotalLESs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Line Errored Seconds encountered
               by  a DS1 interface in the previous 24 hour in-
               terval."
          ::= { dsx1TotalEntry 8 }


        dsx1TotalBESs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
               "The number of Bursty  Errored  Seconds  (BESs)
               encountered  by a DS1 interface in the previous
               24 hour interval."
          ::= { dsx1TotalEntry 9 }


        dsx1TotalDMs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
               "The number of Degraded Minutes  (DMs)  encoun-
               tered  by  a  DS1  interface in the previous 24
               hour interval."
          ::= { dsx1TotalEntry 10 }


        dsx1TotalLCVs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
               "The number of Line Code Violations (LCVs)  en-
               countered  by a DS1 interface in the current 15
               minute interval."
          ::= {dsx1TotalEntry 11 }


     -- The DS1 Far End Group

     -- Implementation of this group is optional for all systems
     -- that attach to a DS1 Interface.
```

```
     -- The DS1 Far End Group consists of three tables:
     --   DS1 Far End Current
     --   DS1 Far End Interval
     --   DS1 Far End Total


     -- The DS1 Far End Current Table


     -- The DS1 Far End Current table contains various statistics
     -- being collected for the current 15 minute interval.
     -- The statistics are collected from the far end messages on the
     -- Facilities Data Link.  The definitions are the same as
     -- described for the near-end information.


         dsx1FarEndCurrentTable OBJECT-TYPE
             SYNTAX   SEQUENCE OF Dsx1FarEndCurrentEntry
             ACCESS   not-accessible
             STATUS   mandatory
             DESCRIPTION
                "The DS1 Far End Current table."
            ::= { ds1 10 }


         dsx1FarEndCurrentEntry OBJECT-TYPE
             SYNTAX   Dsx1FarEndCurrentEntry
             ACCESS   not-accessible
             STATUS   mandatory
             DESCRIPTION
                "An entry in the DS1 Far End Current table."
             INDEX   { dsx1FarEndCurrentIndex }
             ::= { dsx1FarEndCurrentTable 1 }

      Dsx1FarEndCurrentEntry ::=
         SEQUENCE {
             dsx1FarEndCurrentIndex
                 INTEGER,
             dsx1FarEndTimeElapsed
                 INTEGER,
             dsx1FarEndValidIntervals
                 INTEGER,
             dsx1FarEndCurrentESs
                 Gauge,
             dsx1FarEndCurrentSESs
                 Gauge,
             dsx1FarEndCurrentSEFSs
                 Gauge,
             dsx1FarEndCurrentUASs
                 Gauge,
             dsx1FarEndCurrentCSSs
```

```
                  Gauge,
              dsx1FarEndCurrentLESs
                  Gauge,
              dsx1FarEndCurrentPCVs
                  Gauge,
              dsx1FarEndCurrentBESs
                  Gauge,
              dsx1FarEndCurrentDMs
                  Gauge
          }

      dsx1FarEndCurrentIndex OBJECT-TYPE
          SYNTAX  INTEGER (1..'7fffffff'h)
          ACCESS  read-only
          STATUS  mandatory
          DESCRIPTION
              "The index value which uniquely identifies  the
              DS1  interface  to which this entry is applica-
              ble.  The interface identified by a  particular
              value  of  this  index is the same interface as
              identified by the same value  an  dsx1LineIndex
              object instance."
          ::= { dsx1FarEndCurrentEntry 1 }


      dsx1FarEndTimeElapsed OBJECT-TYPE
          SYNTAX  INTEGER (0..899)
          ACCESS  read-only
          STATUS  mandatory
          DESCRIPTION
                  "The number of seconds that  have  elapsed
                  since the beginning of the far end current
                  error-measurement period."
          ::= { dsx1FarEndCurrentEntry 2 }


      dsx1FarEndValidIntervals OBJECT-TYPE
          SYNTAX  INTEGER (0..96)
          ACCESS  read-only
          STATUS  mandatory
          DESCRIPTION
                  "The number of previous far end  intervals
                  for  which  valid data was collected.  The
                  value will be 96 unless the interface  was
                  brought  online  within the last 24 hours,
                  in which case the value will be the number
                  of  complete  15  minute far end intervals
                  since the interface has been online."
```

          ::= { dsx1FarEndCurrentEntry 3 }

       dsx1FarEndCurrentESs OBJECT-TYPE
           SYNTAX   Gauge
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "The number of Far Far End Errored Seconds en-
              countered by a DS1 interface in the current 15
              minute interval."
           ::= { dsx1FarEndCurrentEntry 4 }

       dsx1FarEndCurrentSESs OBJECT-TYPE
           SYNTAX   Gauge
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "The number of Far End Severely Errored Seconds
              encountered by a DS1 interface in the current
              15 minute interval."
           ::= { dsx1FarEndCurrentEntry 5 }

       dsx1FarEndCurrentSEFSs OBJECT-TYPE
           SYNTAX   Gauge
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "The number of Far End Severely Errored Framing
              Seconds encountered by a DS1 interface in the
              current 15 minute interval."
           ::= { dsx1FarEndCurrentEntry 6 }

       dsx1FarEndCurrentUASs OBJECT-TYPE
           SYNTAX   Gauge
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "The number of Unavailable Seconds encountered
              by a DS1 interface in the current 15 minute in-
              terval."
           ::= { dsx1FarEndCurrentEntry 7 }

```
        dsx1FarEndCurrentCSSs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Far End Controlled Slip  Seconds
               encountered  by  a DS1 interface in the current
               15 minute interval."
          ::= { dsx1FarEndCurrentEntry 8 }


        dsx1FarEndCurrentLESs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Far End Line Errored Seconds en-
               countered  by a DS1 interface in the current 15
               minute interval."
          ::= { dsx1FarEndCurrentEntry 9 }


        dsx1FarEndCurrentPCVs OBJECT-TYPE
            SYNTAX  Gauge
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
               "The number of Far End Path  Coding  Violations
               reported  via the far end block error count en-
               countered by a DS1 interface in the current  15
               minute interval."
          ::= { dsx1FarEndCurrentEntry 10 }


        dsx1FarEndCurrentBESs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
               "The number of Bursty  Errored  Seconds  (BESs)
               encountered  by  a DS1 interface in the current
               15 minute interval."
          ::= {dsx1FarEndCurrentEntry 11 }


        dsx1FarEndCurrentDMs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
```

```
            STATUS mandatory
            DESCRIPTION
                "The number of Degraded Minutes (DMs) encoun-
                tered by a DS1 interface  in the current 15
                minute interval."
            ::= { dsx1FarEndCurrentEntry 12 }


    -- The DS1 Far End Interval Table

    -- The DS1 Far End Interval Table contains various statistics
    -- collected by each DS1 interface over the previous 24 hours of
    -- operation.  The past 24 hours are broken into 96
    -- completed 15 minute intervals.

        dsx1FarEndIntervalTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dsx1FarEndIntervalEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
                "The DS1 Far End Interval table."
            ::= { ds1 11 }


        dsx1FarEndIntervalEntry OBJECT-TYPE
            SYNTAX  Dsx1FarEndIntervalEntry
            ACCESS  not-accessible
            STATUS  mandatory
            DESCRIPTION
                "An entry in the DS1 Far End Interval table."
            INDEX   { dsx1FarEndIntervalIndex,
                      dsx1FarEndIntervalNumber }
            ::= { dsx1FarEndIntervalTable 1 }

    Dsx1FarEndIntervalEntry ::=
        SEQUENCE {
            dsx1FarEndIntervalIndex
                INTEGER,
            dsx1FarEndIntervalNumber
                INTEGER,
            dsx1FarEndIntervalESs
                Gauge,
            dsx1FarEndIntervalSESs
                Gauge,
            dsx1FarEndIntervalSEFSs
                Gauge,
            dsx1FarEndIntervalUASs
                Gauge,
```

```
               dsx1FarEndIntervalCSSs
                     Gauge,
               dsx1FarEndIntervalLESs
                     Gauge,
               dsx1FarEndIntervalPCVs
                     Gauge,
               dsx1FarEndIntervalBESs
                     Gauge,
               dsx1FarEndIntervalDMs
                     Gauge
          }

          dsx1FarEndIntervalIndex OBJECT-TYPE
              SYNTAX   INTEGER (1..'7fffffff'h)
              ACCESS   read-only
              STATUS   mandatory
              DESCRIPTION
                 "The index value which uniquely identifies  the
                 DS1  interface  to which this entry is applica-
                 ble.  The interface identified by a  particular
                 value  of  this  index is the same interface as
                 identified by the same value as a dsx1LineIndex
                 object instance."
              ::= { dsx1FarEndIntervalEntry 1 }


          dsx1FarEndIntervalNumber OBJECT-TYPE
              SYNTAX   INTEGER (1..96)
              ACCESS   read-only
              STATUS   mandatory
              DESCRIPTION
                 "A number between 1 and 96, where 1 is the most
                 recently completed 15 minute interval and 96 is
                 the least recently completed 15 minutes  inter-
                 val  (assuming  that  all  96  intervals  are
                 valid)."
              ::= { dsx1FarEndIntervalEntry 2 }


          dsx1FarEndIntervalESs OBJECT-TYPE
              SYNTAX  Gauge
              ACCESS  read-only
              STATUS  mandatory
              DESCRIPTION
                 "The number of Far End Errored Seconds  encoun-
                 tered by a DS1 interface in one of the previous
                 96, individual 15 minute, intervals."
              ::= { dsx1FarEndIntervalEntry 3 }
```

             dsx1FarEndIntervalSESs OBJECT-TYPE
                 SYNTAX   Gauge
                 ACCESS   read-only
                 STATUS   mandatory
                 DESCRIPTION
                    "The number of Far End Severely Errored Seconds
                    encountered by a DS1 interface in one of the
                    previous 96, individual 15 minute, intervals."
                 ::= { dsx1FarEndIntervalEntry 4 }

             dsx1FarEndIntervalSEFSs OBJECT-TYPE
                 SYNTAX   Gauge
                 ACCESS   read-only
                 STATUS   mandatory
                 DESCRIPTION
                    "The number of Far End Severely Errored Framing
                    Seconds encountered by a DS1 interface in one
                    of the previous 96, individual 15 minute, in-
                    tervals."
                 ::= { dsx1FarEndIntervalEntry 5 }

             dsx1FarEndIntervalUASs OBJECT-TYPE
                 SYNTAX   Gauge
                 ACCESS   read-only
                 STATUS   mandatory
                 DESCRIPTION
                    "The number of Unavailable Seconds encountered
                    by a DS1 interface in one of the previous 96,
                    individual 15 minute, intervals."
                 ::= { dsx1FarEndIntervalEntry 6 }

             dsx1FarEndIntervalCSSs OBJECT-TYPE
                 SYNTAX   Gauge
                 ACCESS   read-only
                 STATUS   mandatory
                 DESCRIPTION
                    "The number of Far End Controlled Slip Seconds
                    encountered by a DS1 interface in one of the
                    previous 96, individual 15 minute, intervals."
                 ::= { dsx1FarEndIntervalEntry 7 }

             dsx1FarEndIntervalLESs OBJECT-TYPE
                 SYNTAX   Gauge
                 ACCESS   read-only

```
                STATUS  mandatory
                DESCRIPTION
                   "The number of Far End Line Errored Seconds en-
                   countered by a DS1 interface in one of the pre-
                   vious 96, individual 15 minute, intervals."
                ::= { dsx1FarEndIntervalEntry 8 }


          dsx1FarEndIntervalPCVs OBJECT-TYPE
                SYNTAX  Gauge
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                   "The number of Far End Path  Coding  Violations
                   reported  via the far end block error count en-
                   countered by a DS1 interface in one of the pre-
                   vious 96, individual 15 minute, intervals."
                ::= { dsx1FarEndIntervalEntry 9 }


          dsx1FarEndIntervalBESs OBJECT-TYPE
                SYNTAX Gauge
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                   "The number of Bursty  Errored  Seconds  (BESs)
                   encountered  by  a  DS1 interface in one of the
                   previous 96, individual 15 minute, intervals."
                ::= {dsx1FarEndIntervalEntry 10 }


          dsx1FarEndIntervalDMs OBJECT-TYPE
                SYNTAX Gauge
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                   "The number of Degraded Minutes  (DMs)  encoun-
                   tered by a DS1 interface in one of the previous
                   96, individual 15 minute, intervals."
                ::= { dsx1FarEndIntervalEntry 11 }


      -- The DS1 Far End Total Table

      -- The DS1 Far End Total Table contains the cumulative sum of the
      -- various statistics for the 24 hour period preceding the
      -- current interval.
```

```
        dsx1FarEndTotalTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dsx1FarEndTotalEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
               "The DS1 Far End Total table."
           ::= { ds1 12 }


        dsx1FarEndTotalEntry OBJECT-TYPE
            SYNTAX   Dsx1FarEndTotalEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
               "An entry in the DS1 Far End Total table."
            INDEX   { dsx1FarEndTotalIndex }
            ::= { dsx1FarEndTotalTable 1 }

     Dsx1FarEndTotalEntry ::=
         SEQUENCE {
             dsx1FarEndTotalIndex
                 INTEGER,
             dsx1FarEndTotalESs
                 Gauge,
             dsx1FarEndTotalSESs
                 Gauge,
             dsx1FarEndTotalSEFSs
                 Gauge,
             dsx1FarEndTotalUASs
                 Gauge,
             dsx1FarEndTotalCSSs
                 Gauge,
             dsx1FarEndTotalLESs
                 Gauge,
             dsx1FarEndTotalPCVs
                 Gauge,
             dsx1FarEndTotalBESs
                 Gauge,
             dsx1FarEndTotalDMs
                 Gauge
         }

        dsx1FarEndTotalIndex OBJECT-TYPE
            SYNTAX   INTEGER (1..'7fffffff'h)
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
               "The index value which uniquely identifies  the
```

                         DS1 interface to which this entry is applica-
                         ble. The interface identified by a particular
                         value of this index is the same interface as
                         identified by the same value an dsx1LineIndex
                         object instance."
                    ::= { dsx1FarEndTotalEntry 1 }

                dsx1FarEndTotalESs OBJECT-TYPE
                    SYNTAX Gauge
                    ACCESS read-only
                    STATUS mandatory
                    DESCRIPTION
                        "The number of Far End Errored Seconds encoun-
                        tered by a DS1 interface in the previous 24
                        hour interval."
                    ::= { dsx1FarEndTotalEntry 2 }

                dsx1FarEndTotalSESs OBJECT-TYPE
                    SYNTAX Gauge
                    ACCESS read-only
                    STATUS mandatory
                    DESCRIPTION
                        "The number of Far End Severely Errored Seconds
                        encountered by a DS1 interface in the previous
                        24 hour interval."
                    ::= { dsx1FarEndTotalEntry 3 }

                dsx1FarEndTotalSEFSs OBJECT-TYPE
                    SYNTAX Gauge
                    ACCESS read-only
                    STATUS mandatory
                    DESCRIPTION
                        "The number of Far End Severely Errored Framing
                        Seconds encountered by a DS1 interface in the
                        previous 24 hour interval."
                    ::= { dsx1FarEndTotalEntry 4 }

                dsx1FarEndTotalUASs OBJECT-TYPE
                    SYNTAX Gauge
                    ACCESS read-only
                    STATUS mandatory
                    DESCRIPTION
                        "The number of Unavailable Seconds encountered
                        by a DS1 interface in the previous 24 hour in-

            terval."
        ::= { dsx1FarEndTotalEntry 5 }

        dsx1FarEndTotalCSSs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Far End Controlled Slip Seconds
                encountered by a DS1 interface in the previous
                24 hour interval."
        ::= { dsx1FarEndTotalEntry 6 }

        dsx1FarEndTotalLESs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Far End Line Errored Seconds en-
                countered by a DS1 interface in the previous 24
                hour interval."
        ::= { dsx1FarEndTotalEntry 7 }

        dsx1FarEndTotalPCVs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Far End Path Coding Violations
                reported via the far end block error count en-
                countered by a DS1 interface in the previous 24
                hour interval."
        ::= { dsx1FarEndTotalEntry 8 }

        dsx1FarEndTotalBESs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
                "The number of Bursty Errored Seconds (BESs)
                encountered by a DS1 interface in the previous
                24 hour interval."
        ::= { dsx1FarEndTotalEntry 9 }

```
        dsx1FarEndTotalDMs OBJECT-TYPE
            SYNTAX Gauge
            ACCESS read-only
            STATUS mandatory
            DESCRIPTION
               "The number of Degraded Minutes  (DMs)  encoun-
               tered  by  a  DS1  interface in the previous 24
               hour interval."
           ::= { dsx1FarEndTotalEntry 10 }
```

-- the DS1 Fractional Group

-- Implementation of this group is mandatory for those
-- systems dividing a DS1 into channels containing different
-- data streams that are of local interest. Systems which
-- are indifferent to data content, such as CSUs, need not
-- implement it.

-- The DS1 fractional table identifies which DS1 channels
-- associated with a CSU are being used to support a
-- logical interface, i.e., an entry in the interfaces table
-- from the Internet-standard MIB.

-- For example, consider an application managing a North
-- American ISDN Primary Rate link whose division is a 384 kbit/s
-- H1 "B" Channel for Video, a second H1 for data to a primary
-- routing peer, and 12 64 kbit/s H0 "B" Channels. Consider that
-- some subset of the H0 channels are used for voice and the
-- remainder are available for dynamic data calls.

-- we count a total of 14 interfaces multiplexed onto the DS1
-- interface. Six DS1 channels (for the sake of the example,
-- channels 1..6) are used for Video, six more (7..11 and 13)
-- are used for data, and the remaining 12 are are in channels
-- 12 and 14..24.

-- Let us further imagine that ifIndex 2 is of type DS1 and
-- refers to the DS1 interface, and that the interfaces layered
-- onto it are numbered 3..16.

-- We might describe the allocation of channels, in the
-- dsx1FracTable, as follows:

-- dsx1FracIfIndex.2. 1 = 3   dsx1FracIfIndex.2.13 = 4
-- dsx1FracIfIndex.2. 2 = 3   dsx1FracIfIndex.2.14 = 6
-- dsx1FracIfIndex.2. 3 = 3   dsx1FracIfIndex.2.15 = 7
-- dsx1FracIfIndex.2. 4 = 3   dsx1FracIfIndex.2.16 = 8

```
    -- dsx1FracIfIndex.2. 5 = 3    dsx1FracIfIndex.2.17 = 9
    -- dsx1FracIfIndex.2. 6 = 3    dsx1FracIfIndex.2.18 = 10
    -- dsx1FracIfIndex.2. 7 = 4    dsx1FracIfIndex.2.19 = 11
    -- dsx1FracIfIndex.2. 8 = 4    dsx1FracIfIndex.2.20 = 12
    -- dsx1FracIfIndex.2. 9 = 4    dsx1FracIfIndex.2.21 = 13
    -- dsx1FracIfIndex.2.10 = 4    dsx1FracIfIndex.2.22 = 14
    -- dsx1FracIfIndex.2.11 = 4    dsx1FracIfIndex.2.23 = 15
    -- dsx1FracIfIndex.2.12 = 5    dsx1FracIfIndex.2.24 = 16


    --        For North American (DS1) interfaces, there are 24 legal
    --        channels, numbered 1 through 24.

    --        For G.704 interfaces, there are 31 legal channels,
    --        numbered 1 through 31.  The channels (1..31) correspond
    --        directly to the equivalently numbered time-slots.

        dsx1FracTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dsx1FracEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
               "The DS1 Fractional table."
           ::= { ds1 13 }


        dsx1FracEntry OBJECT-TYPE
            SYNTAX  Dsx1FracEntry
            ACCESS  not-accessible
            STATUS  mandatory
            DESCRIPTION
               "An entry in the DS1 Fractional table."
            INDEX   { dsx1FracIndex, dsx1FracNumber }
            ::= { dsx1FracTable 1 }

    Dsx1FracEntry ::=
        SEQUENCE {
            dsx1FracIndex
                INTEGER,
            dsx1FracNumber
                INTEGER,
            dsx1FracIfIndex
                INTEGER
        }


        dsx1FracIndex OBJECT-TYPE
            SYNTAX   INTEGER (1..'7fffffff'h)
```

```
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                    "The index value which uniquely identifies  the
                    DS1  interface  to which this entry is applica-
                    ble.  The interface identified by a  particular
                    value  of  this  index is the same interface as
                    identified by the same value  an  dsx1LineIndex
                    object instance."
                ::= { dsx1FracEntry 1 }


        dsx1FracNumber OBJECT-TYPE
                SYNTAX  INTEGER (1..31)
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                    "The channel number for this entry."
                ::= { dsx1FracEntry 2 }


        dsx1FracIfIndex OBJECT-TYPE
                SYNTAX  INTEGER (1..'7fffffff'h)
                ACCESS  read-write
                STATUS  mandatory
                DESCRIPTION
                    "An index value that uniquely identifies an in-
                    terface.  The interface identified by a partic-
                    ular value of this index is the same  interface
                    as  identified by the same value an ifIndex ob-
                    ject instance. If no interface is currently us-
                    ing  a channel, the value should be zero.  If a
                    single interface occupies more  than  one  time
                    slot,  that ifIndex value will be found in mul-
                    tiple time slots."
                ::= { dsx1FracEntry 3 }

        END
```

5. Acknowledgements

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Security Considerations

    Security issues are not discussed in this memo.

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