Definitions of Managed Objects for the DS1, E1, DS2 and E2 Interface Types

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Status of this Memo

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Abstract

This memo defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes objects used for managing DS1, E1, DS2 and E2 interfaces. This document is a companion document with Definitions of Managed Objects for the DS0, DS3/E3 and SONET/SDH Interface Types, rfcTBD [30], rfcTBD [28] and rfcTBD [29].

This memo specifies a MIB module in a manner that is both compliant to the SNMPv2 SMI, and semantically identical to the peer SNMPv1 definitions.

This memo does not specify a standard for the Internet community.

This document entirely replaces RFC 1406.

1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2271 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in RFC 1155 [2], RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in RFC 1902 [5], RFC 1903 [6] and RFC 1904 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2272 [11] and RFC 2274 [12].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- A set of fundamental applications described in RFC 2273 [14] and the view-based access control mechanism described in RFC 2275 [15]. Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI. This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are

omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

1.1. Changes from RFC1406

The changes from RFC1406 are the following:

(1) The Fractional Table has been deprecated.

(2) This document uses SMIv2.

(3) Usage is given for ifTable and ifXTable.

(4) Example usage of ifStackTable is included.

(5) dsx1IfIndex has been deprecated.

(6) Support for DS2 and E2 have been added.

(7) Additional lineTypes for DS2, E2, and unframed E1 were added.

(8) The definition of valid intervals has been clarified for the case where the agent proxied for other devices. In particular, the treatment of missing intervals has been clarified.

(9) An inward loopback has been added.

(10) Additional lineStatus bits have been added for Near End in Unavailable Signal State, Carrier Equipment Out of Service, DS2 Payload AIS, and DS2 Performance Threshold.

(11) A read-write line Length object has been added.

(12) Signal mode of other has been added.

(13) Added a lineStatus last change, trap and enabler.

(14) The e1(19) ifType has been obsoleted so this MIB does not list it as a supported ifType.

(15) Textual Conventions for statistics objects have been used.

(16) A new object, dsx1LoopbackStatus has been introduced to reflect the loopbacks established on a DS1 interface and the source to the requests. dsx1LoopbackConfig continues to be the desired loopback state while dsx1LoopbackStatus reflects the actual state.

(17) A dual loopback has been added to allow the setting of an inward loopback and a line loopback at the same time.

(18) An object indicating which channel to use within a parent object (i.e. DS3) has been added.

(19) An object has been added to indicate whether or not this DS1/E1 is channelized.

(20) Line coding type of B6ZS has been added for DS2

2. Overview

These objects are used when the particular media being used to realize an interface is a DS1/E1/DS2/E2 interface. At present, this applies to these values of the ifType variable in the Internet-standard MIB:

ds1 (18)

The definitions contained herein are based on the AT&T T-1 Superframe (a.k.a., D4) and Extended Superframe (ESF) formats [17, 18], the latter of which conforms to ANSI specifications [19], and the CCITT Recommendations [20, 21], referred to as E1 for the rest of this memo.

The various DS1 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. Therefore, interface types e1(19) and g703at2mb(67) have been obsoleted.

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

2.1. Use of ifTable for DS1 Layer

Only the ifGeneralGroup needs to be supported.

ifTable Object	Use for DS1 Layer
ifIndex	Interface index.
ifDescr	See interfaces MIB [16]
ifType	ds1(18)
ifSpeed	Speed of line rate DS1 - 1544000 E1 - 2048000 DS2 - 6312000 E2 - 8448000

ifPhysAddress	The value of the Circuit Identifier. If no Circuit Identifier has been assigned this object should have an octet string with zero length.
ifAdminStatus	See interfaces MIB [16]
ifOperStatus	See interfaces MIB [16]
ifLastChange	See interfaces MIB [16]
ifName	See interfaces MIB [16].
ifLinkUpDownTrapEnable	Set to enabled(1).
ifHighSpeed	Speed of line in Mega-bits per second (2, 6, or 8)
ifConnectorPresent	Set to true(1) normally, except for cases such as DS1/E1 over AAL1/ATM where false(2) is appropriate

2.2. Usage Guidelines

2.2.1. Usage of ifStackTable for Routers and DSUs

The object dsx1IfIndex has been deprecated. This object previously allowed a very special proxy situation to exist for Routers and CSUs. This section now describes how to use ifStackTable to represent this relationship.

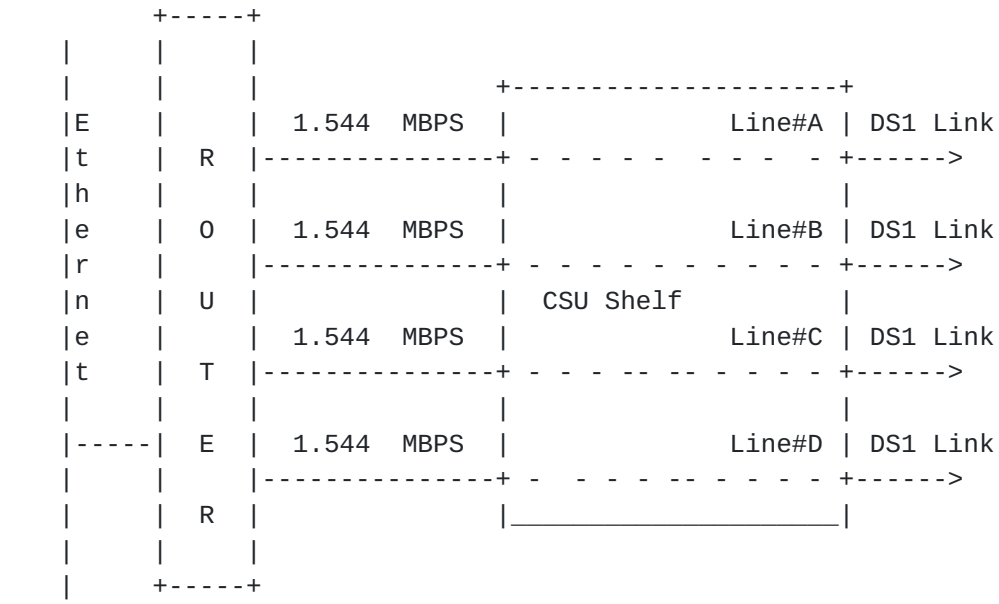
The paragraphs discussing dsx1IfIndex and dsx1LineIndex have been preserved in Appendix A for informational purposes.

The ifStackTable is used in the proxy case to represent the association between pairs of interfaces, e.g. this T1 is attached to that T1. This use is consistent with the use of the ifStackTable to show the association between various sub-layers of an interface. In both cases entire PDUs are exchanged between the interface pairs - in the case of a T1, entire T1 frames are exchanged; in the case of PPP and HDLC, entire HDLC frames are exchanged. This usage is not meant to suggest the use of the ifStackTable to represent Time Division Multiplexing (TDM) connections in general.

External&Internal interface scenario: the SNMP Agent resides on a host external from the device supporting DS1 interfaces (e.g., a router). The Agent represents both the host and the DS1 device.

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:



The assignment of the index values could for example be:

ifIndex	Description
1	Ethernet
2	Line#A Router
3	Line#B Router
4	Line#C Router
5	Line#D Router
6	Line#A CSU Router
7	Line#B CSU Router
8	Line#C CSU Router
9	Line#D CSU Router
10	Line#A CSU Network
11	Line#B CSU Network
12	Line#C CSU Network
13	Line#D CSU Network

The ifStackTable is then used to show the relationships between the various DS1 interfaces.

ifStackTable Entries

HigherLayer	LowerLayer
2	6
3	7
4	8
5	9
6	10
7	11
8	12
9	13

If the CSU shelf is managed by itself by a local SNMP Agent, the situation would be identical, except the Ethernet and the 4 router interfaces are deleted. Interfaces would also be numbered from 1 to 8.

ifIndex	Description
1	Line#A CSU Router
2	Line#B CSU Router
3	Line#C CSU Router
4	Line#D CSU Router
5	Line#A CSU Network
6	Line#B CSU Network
7	Line#C CSU Network
8	Line#D CSU Network

ifStackTable Entries

HigherLayer	LowerLayer
1	5
2	6
3	7
4	8

2.2.2. Usage of ifStackTable for DS1/E1 on DS2/E2

An example is given of how DS1/E2 interfaces are stacked on DS2/E2 interfaces. It is not necessary nor is it always desirable to represent DS2 interfaces. If this is required, the following stacking should be used. All ifTypes are ds1. The DS2 is determined by examining ifSpeed or dsx1LineType.

```
ifIndex  Description
1        DS1 #1
2        DS1 #2
3        DS1 #3
4        DS1 #4
5        DS2
```

ifStackTable Entries

```
HigherLayer   LowerLayer
1             5
2             5
3             5
4             5
```

2.2.3. Usage of Channelization for DS3, DS1, DS0

An example is given here to explain the channelization objects in the DS3, DS1, and DS0 MIBs to help the implementor use the objects correctly. Treatment of E3 and E1 would be similar, with the number of DS0s being different depending on the framing of the E1.

Assume that a DS3 (with ifIndex 1) is Channelized into DS1s (without DS2s). The object dsx3Channelization is set to enabledDs1. There will be 28 DS1s in the ifTable. Assume the entries in the ifTable for the DS1s are created in channel order and the ifIndex values are 2 through 29. **In the DS1 MIB, there will be an entry in the dsx1ChanMappingTable** for each ds1. The entries will be as follows:

dsx1ChanMappingTable Entries

```
ifIndex  dsx1Ds1ChannelNumber   dsx1ChanMappedIfIndex
1        1                      2
1        2                      3
.......
1        28                     29
```

In addition, the DS1s are channelized into DS0s. The object dsx1Channelization is set to enabledDS0 for each DS1. When this object is set to this value, 24 DS0s are created by the agent. There will be 24 DS0s in the ifTable for each DS1. If the dsx1Channelization is set to disabled, the 24 DS0s are destroyed.

Assume the entries in the ifTable are created in channel order and the

ifIndex values for the DS0s in the first DS1 are 30 through 53. In the DS0 MIB, there will be an entry in the dsx0ChanMappingTable for each DS0. The entries will be as follows:

dsx0ChanMappingTable Entries

ifIndex	dsx0Ds0ChannelNumber	dsx0ChanMappedIfIndex
2	1	30
2	2	31
.....		
2	24	53

2.2.4. Usage of Channelization for DS3, DS2, DS1

An example is given here to explain the channelization objects in the DS3 and DS1 MIBs to help the implementor use the objects correctly.

Assume that a DS3 (with ifIndex 1) is Channelized into DS2s. The object dsx3Channelization is set to enabledDs2. There will be 7 DS2s (ifType of DS1) in the ifTable. Assume the entries in the ifTable for the DS2s are created in channel order and the ifIndex values are 2 through 8. In the DS1 MIB, there will be an entry in the dsx1ChanMappingTable for each DS2. The entries will be as follows:

dsx1ChanMappingTable Entries

ifIndex	dsx1Ds1ChannelNumber	dsx1ChanMappedIfIndex
1	1	2
1	2	3
.....		
1	7	8

In addition, the DS2s are channelized into DS1s. The object dsx1Channelization is set to enabledDS1 for each DS2. There will be **4 DS1s in the ifTable for each DS2.** Assume the entries in the ifTable are created in channel order and the ifIndex values for the DS1s in the first DS2 are 9 through 12, then 13 through 16 for the second DS2, and so on. In the DS1 MIB, there will be an entry in the dsx1ChanMappingTable for each DS1. The entries will be as follows:

dsx1ChanMappingTable Entries

ifIndex	dsx1Ds1ChannelNumber	dsx1ChanMappedIfIndex
2	1	9

```
        2         2                    10
        2         3                    11
        2         4                    12
        3         1                    13
        3         2                    14
        ...
        8         4                    36
```

2.2.5. Usage of Loopbacks

This section discusses the behaviour of objects related to loopbacks.

The object dsx1LoopbackConfig represents the desired state of loopbacks on this interface. Using this object a Manager can request:

- LineLoopback
- PayloadLoopback (if ESF framing)
- InwardLoopback
- DualLoopback (Line + Inward)
- NoLoopback

The remote end can also request loopbacks either through the FDL channel if ESF or inband if D4. The loopbacks that can be request this way are:

- LineLoopback
- PayloadLoopback (if ESF framing)
- NoLoopback

To model the current state of loopbacks on a DS1 interface, the object dsx1LoopbackStatus defines which loopback is currently applies to an interface. This objects, which is a bitmap, will have bits turned on which reflect the currently active loopbacks on the interface as well as the source of those loopbacks.

The following restrictions/rules apply to loopbacks:

The far end cannot undo loopbacks set by a manager.

A manager can undo loopbacks set by the far end.

Both a line loopback and an inward loopback can be set at the same time. Only these two loopbacks can co-exist and either one may be set by the manager or the far end. A LineLoopback request from the far end is incremental to an existing Inward loopback established by a manager. When a NoLoopback is received from the far end in this case, the InwardLoopback remains in place.

2.3. 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, E1, DS2, or E3 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 these types devices that are currently deployed.

J2 interfaces are not supported by this MIB.

2.4. 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 late but not final draft of what became the ANSI T1.231 standard [11]. If the definition in this document does not match the definition in the ANSI T1.231 document, the implementer should follow the definition described in this document.

2.4.1. 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. (See T1.231 Section 6.1.1.1.1) 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. (See T1.231 Section 6.1.1.1.2) 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. (Also known as CV-L; See T1.231 Section 6.5.1.1)

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 or frame

synch. bit error in the ESF and E1-CRC formats. (Also known as CV-P; See T1.231 Section 6.5.2.1)

Controlled Slip (CS) Error Event

A Controlled Slip is the replication or deletion of the payload bits of a DS1 frame. (See T1.231 Section 6.1.1.2.3) 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.

2.4.2. Performance Defects

Out Of Frame (OOF) Defect

An OOF defect is the occurrence of a particular density of Framing Error events. (See T1.231 Section 6.1.2.2.1)

For DS1 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 [26]).

For DS2 links, an Out of Frame defect is declared when 7 or more consecutive errored framing patterns (4 multiframe) are received. The LOF is cleared when 3 or more consecutive correct framing patterns are received.

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. (See G.704 Section 4.1)

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. (See G.775, Section 5.4)

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 [23] Section 3.3.2).

For DS2 links, the DS2 AIS shall be sent from the NT1 to the user to indicate a loss of the 6,312 kbps frame capability on the network side. The DS2 AIS is defined as a bit array of 6,312 kbps in which all binary bits are set to '1'.

The DS2 AIS detection and removal shall be implemented according to ITU-T Draft Recommendation G.775[31] Section 5.5:
- a DS2 AIS defect is detected when the incoming signal has two (2) or less ZEROs in a sequence of 3156 bits (0.5 ms).
- a DS2 AIS defect is cleared when the incoming signal has three (3) or more ZEROs in a sequence of 3156 bits (0.5 ms).

2.4.3. 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. Performance parameters continue to be collected when the interface is down.

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.

Performance parameters are of types PerfCurrentCount, PerfIntervalCount and PerfTotalCount. These textual conventions are all Gauge32, and they are used because it is possible for these objects to decrease. Objects may decrease when Unavailable Seconds

occurs across a fifteen minutes interval boundary. See Unavailable Seconds discussion later in this section.

Line Errored Seconds (LES)
A Line Errored Second is a second in which one or more Line Code Violation error events were detected. (Also known as ES-L; See T1.231 Section 6.5.1.2)

Controlled Slip Seconds (CSS)
A Controlled Slip Second is a one-second interval containing one or more controlled slips. (See T1.231 Section 6.5.2.8) This is not incremented during an Unavailable Second.

Errored Seconds (ES)
For ESF and E1-CRC links an Errored Second is a second with one or more Path Code Violation OR one or more Out of Frame defects OR one or more Controlled Slip events OR a detected AIS defect. (See T1.231 Section 6.5.2.2 and G.826[32] Section B.1)

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 in T1.231 Section 6.5.2.4) 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. It applies to ESF signals only.

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. (See T1.231 Section 6.5.2.5)

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. (Also known as SAS-P (SEF/AIS second); See T1.231 Section 6.5.2.6)

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[24]).

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.

Note that this definition implies that the agent cannot determine until after a ten second interval has passed whether a given one-second interval belongs to available or unavailable time. If the agent chooses to update the various performance statistics in real time then it must be prepared to retroactively reduce the ES, BES, SES, and SEFS counts by 10 and increase the UAS count by 10 when it determines that available time has been entered. It must also be prepared to adjust the PCV count and the DM count as necessary since these parameters are not accumulated during unavailable time. It must be similarly prepared to retroactively decrease the UAS count by 10 and increase the ES, BES, and DM counts as necessary upon entering available time. A special case exists when the 10 second period leading to available or unavailable time crosses a 900 second statistics window boundary, as the foregoing description implies that the ES, BES, SES, SEFS, DM, and UAS counts the PREVIOUS interval must be adjusted. In this case 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.

The agent may instead choose to delay updates to the various statistics by 10 seconds in order to avoid retroactive adjustments to the counters. A way to do this is sketched in Appendix B.

In any case, a linkDown trap shall be sent only after the agent has determined for certain that the unavailable state has been entered, but the time on the trap will be that of the first UAS (i.e., 10 seconds earlier). A linkUp trap shall be handled similarly.

According to ANSI T1.231 unavailable time begins at the _onset_ of 10 contiguous severely errored seconds -- that is, unavailable time starts with the _first_ of the 10 contiguous SESs. Also, while an interface is deemed unavailable all counters for that interface are frozen except for the UAS count. It follows that an implementation which strictly complies with this standard must _not_ increment any counters

other than the UAS count -- even temporarily -- as a result of anything that happens during those 10 seconds. Since changes in the signal state lag the data to which they apply by 10 seconds, an ANSI-compliant implementation must pass the the one-second statistics through a 10-second delay line prior to updating any counters. That can be done by performing the following steps at the end of each one second interval.

i) Read near/far end CV counter and alarm status flags from the hardware.

ii) Accumulate the CV counts for the preceding second and compare them to the ES and SES threshold for the layer in question. Update the signal state and shift the one-second CV counts and ES/SES flags into the 10-element delay line. Note that far-end one-second statistics are to be flagged as "absent" during any second in which there is an incoming defect at the layer in question or at any lower layer.

iii) Update the current interval statistics using the signal state from the _previous_ update cycle and the one-second CV counts and ES/SES flags shifted out of the 10-element delay line.

This approach is further described in Appendix B.

2.4.4. 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 DS1 case, "Distant Alarm" in the E1 case, and "Remote Alarm" in the DS2 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.

For DS2 links, if a loss of frame alignment (LOF or LOS) and/or DS2 AIS condition, is detected, the RAI signal shall be generated and transmitted to the remote side.

The Remote Alarm Indication(RAI) signal is defined on m-bits as a repetition of the 16bit sequence consisting of eight binary '1s' and eight binary '0s' in m-bits(1111111100000000). When the RAI signal is not sent (in normal operation),the HDLC flag pattern (01111110) in the m-bit is sent.

The RAI failure is detected when 16 or more consecutive RAI-patterns (1111111100000000) are received. The RAI failure is cleared when 4 or more consecutive incorrect-RAI-patterns are received.

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. (See T1.231 Section 6.2.1.2.1)

An AIS defect at a 6312 kbit/s (G.704) interface is detected when the incoming signal has two {2} or less ZEROs in a sequence of 3156 bits (0.5ms).

The AIS signal defect is cleared when the incoming signal has three {3} or more ZEROs in a sequence of 3156 bits (0.5ms).

Loss Of Frame Failure

For DS1 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 [25].

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

Loss Of Signal Failure

For DS1, 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).

A LOS defect at 6312kbit/s interfaces is detected when the incoming signal has "no transitions", i.e. when the signal level is less than or equal to a signal level of 35dB below nominal, for N consecutive pulse intervals, where 10 <=N<=255.

The LOS defect is cleared when the incoming signal has "transitions", i.e. when the signal level is greater than or equal to a signal level of 9dB below nominal, for N consecutive pulse intervals, where 10<=N<=255.

A signal with "transitions" corresponds to a G.703 compliant signal.

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 DS1.

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 [27] 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. (See G.732)

DS2 Payload AIS Failure
The DS2 Payload AIS is detected when the incoming signal of the 6,312 kbps frame payload [TS1-TS96] has 2 or less 0's in a sequence of 3072 bits (0.5ms). The DS2 Payload AIS is cleared when the incoming signal of the 6,312 kbps frame payload [TS1-TS96] has 3 or more 0's in a sequence of 3072 bits (0.5 ms).

DS2 Performance Threshold
DS2 Performance Threshold Failure monitors equipment performance and is based on the CRC (Cyclic Redundancy Check) Procedure defined in G.704.

The DS2 Performance Threshold Failure is detected when the bit error ratio exceeds 10^-4 (Performance Threshold), and the DS2 Performance Threshold Failure shall be cleared when the bit error ratio decreased to less than 10^-6."

2.4.5. 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.

Proxy

In this document, the word proxy is meant to indicate an application which receives SNMP messages and replies to them on behalf of the devices which implement the actual DS3/E3 interfaces. The proxy may have already collected the information about the DS3/E3 interfaces into its local database and may not necessarily forward the requests to the actual DS3/E3 interface. It is expected in such an application that there are periods of time where the proxy is not communicating with the DS3/E3 interfaces. In these instances the proxy will not necessarily have up-to-date configuration information and will most likely have missed the collection of some statistics data. Missed statistics data collection will result in invalid data in the interval table.

3. Object Definitions

```
DS1-MIB DEFINITIONS ::= BEGIN

IMPORTS
     MODULE-IDENTITY, OBJECT-TYPE,
     NOTIFICATION-TYPE, transmission         FROM SNMPv2-SMI
     DisplayString, TimeStamp, TruthValue    FROM SNMPv2-TC
     MODULE-COMPLIANCE, OBJECT-GROUP,
     NOTIFICATION-GROUP                      FROM SNMPv2-CONF
     InterfaceIndex, ifIndex                 FROM IF-MIB
     PerfCurrentCount, PerfIntervalCount,
     PerfTotalCount                          FROM PerfHist-TC-MIB;


ds1 MODULE-IDENTITY
    LAST-UPDATED "9808011830Z"
    ORGANIZATION "IETF Trunk MIB Working Group"
    CONTACT-INFO
      "        David Fowler

       Postal: Newbridge Networks Corporation
               600 March Road
               Kanata, Ontario, Canada K2K 2E6

               Tel: +1 613 591 3600
               Fax: +1 613 599 3667

       E-mail: davef@newbridge.com"
    DESCRIPTION
         "The MIB module to describe DS1, E1, DS2, and
          E2 interfaces objects."

    ::= { transmission 18 }

-- note that this subsumes cept (19) and g703at2mb (67)
-- there is no separate CEPT or G703AT2MB MIB
```

```
          -- The DS1 Near End Group

          -- The DS1 Near End Group consists of five tables:
          --    DS1 Configuration
          --    DS1 Current
          --    DS1 Interval
          --    DS1 Total
          --    DS1 Channel Table

          -- The DS1 Configuration Table

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

          dsx1ConfigEntry OBJECT-TYPE
               SYNTAX  Dsx1ConfigEntry
               MAX-ACCESS  not-accessible
               STATUS  current
               DESCRIPTION
                      "An entry in the DS1 Configuration table."
               INDEX   { dsx1LineIndex }
               ::= { dsx1ConfigTable 1 }

          Dsx1ConfigEntry ::=
               SEQUENCE {
                   dsx1LineIndex                    InterfaceIndex,
                   dsx1IfIndex                      InterfaceIndex,
                   dsx1TimeElapsed                  INTEGER,
                   dsx1ValidIntervals               INTEGER,
                   dsx1LineType                     INTEGER,
                   dsx1LineCoding                   INTEGER,
                   dsx1SendCode                     INTEGER,
                   dsx1CircuitIdentifier            DisplayString,
                   dsx1LoopbackConfig               INTEGER,
                   dsx1LineStatus                   INTEGER,
                   dsx1SignalMode                   INTEGER,
                   dsx1TransmitClockSource          INTEGER,
                   dsx1Fdl                          INTEGER,
                   dsx1InvalidIntervals             INTEGER,
                   dsx1LineLength                   INTEGER,
```

```
            dsx1LineStatusLastChange            TimeStamp,
            dsx1LineStatusChangeTrapEnable      INTEGER,
            dsx1LoopbackStatus                  INTEGER,
            dsx1Ds1ChannelNumber                INTEGER,
            dsx1Channelization                  INTEGER
        }

        dsx1LineIndex OBJECT-TYPE
             SYNTAX  InterfaceIndex
             MAX-ACCESS  read-only
             STATUS  current
             DESCRIPTION
                    "This object should be made equal to ifIndex.  The
                    next paragraph describes its previous usage.
                    Making the object equal to ifIndex allows proper
                    use of ifStackTable and ds0/ds0bundle mibs.

                    Previously, this object is the identifier of 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 that is
                    greater than ifNumber and numbering the 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  InterfaceIndex
             MAX-ACCESS  read-only
             STATUS  deprecated
             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)
             MAX-ACCESS  read-only
             STATUS  current
             DESCRIPTION
```

```
                "The number of seconds that have elapsed since the
                beginning of the near end current error-
                measurement period."
            ::= { dsx1ConfigEntry 3 }

        dsx1ValidIntervals OBJECT-TYPE
            SYNTAX  INTEGER (0..96)
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                "The number of previous near 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 near end
                intervals since the interface has been online.  In
                the case where the agent is a proxy, it is
                possible that some intervals are unavailable.  In
                this case, this interval is the maximum interval
                number for which valid data is available."
            ::= { dsx1ConfigEntry 4 }

        dsx1LineType OBJECT-TYPE
            SYNTAX  INTEGER {
                        other(1),
                        dsx1ESF(2),
                        dsx1D4(3),
                        dsx1E1(4),
                        dsx1E1CRC(5),
                        dsx1E1MF(6),
                        dsx1E1CRCMF(7),
                        dsx1Unframed(8),
                        dsx1E1Unframed(9),
                        dsx1DS2M12(10),
                        dsx2E2(11)
                    }
            MAX-ACCESS  read-write
            STATUS  current
            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 (T1.107)
                    dsx1D4          AT&T D4 format DS1 (T1.107)
                    dsx1E1          ITU-T Recommendation G.704
                                     (Table 4a)
                    dsx1E1-CRC      ITU-T 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
                    dsx1Unframed    DS1 with No Framing
                    dsx1E1Unframed  E1 with No Framing (G.703)
                    dsx1DS2M12      DS2 frame format (T1.107)
                    dsx1E2          E2 frame format (G.704)

                    For clarification, the capacity for each E1 type
                    is as listed below:
                    dsx1E1Unframed - E1, no framing = 32 x 64k = 2048k
                    dsx1E1 or dsx1E1CRC - E1, with framing,
                       no signalling = 31 x 64k = 1984k
                    dsx1E1MF or dsx1E1CRCMF - E1, with framing,
                       signalling = 30 x 64k = 1920k

                    For further information See ITU-T Recomm G.704"
               ::= { dsx1ConfigEntry 5 }

          dsx1LineCoding OBJECT-TYPE
               SYNTAX  INTEGER {
                          dsx1JBZS (1),
                          dsx1B8ZS (2),
                          dsx1HDB3 (3),
                          dsx1ZBTSI (4),
                          dsx1AMI (5),
                          other(6),
                          dsx1B6ZS(7)
                       }
               MAX-ACCESS  read-write
               STATUS  current
               DESCRIPTION
                       "This variable describes the variety of Zero Code
                       Suppression used on this interface, which in turn
                       affects a number of its characteristics.

                       dsx1JBZS refers the Jammed Bit Zero Suppression,
```

```
                    in which the AT&T specification of at least one
                    pulse every 8 bit periods is literally implemented
                    by forcing a pulse in bit 8 of each channel.
                    Thus, only seven bits per channel, or 1.344 Mbps,
                    is available for data.

                    dsx1B8ZS refers to the use of a specified pattern
                    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
                    requirements, such as inverting HDLC data.

                    dsx1B6ZS refers to the user of a specifed pattern
                    of normal bits and bipolar violations which are
                    used to replace a sequence of six zero bits.  Used
                    for DS2."

               ::= { dsx1ConfigEntry 6 }

          dsx1SendCode OBJECT-TYPE
               SYNTAX  INTEGER {
                         dsx1SendNoCode(1),
                         dsx1SendLineCode(2),
                         dsx1SendPayloadCode(3),
                         dsx1SendResetCode(4),
                         dsx1SendQRS(5),
                         dsx1Send511Pattern(6),
                         dsx1Send3in24Pattern(7),
                         dsx1SendOtherTestPattern(8)
                         }
               MAX-ACCESS  read-write
               STATUS  current
               DESCRIPTION
                       "This variable indicates what type of code is
```

```
                being sent across the DS1 interface by the device.
                Setting this variable causes the interface to send
                the code requested.  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))
            MAX-ACCESS  read-write
            STATUS  current
            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),
                    dsx1InwardLoop(5),
                    dsx1DualLoop(6)
                  }
          MAX-ACCESS  read-write
          STATUS  current
          DESCRIPTION
                 "This variable represents the desired loopback
                 configuration of the DS1 interface.  Agents
                 supporting read/write access should return
                 inconsistentValue 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 its value.

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

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

                 dsx1OtherLoop
                  Loopbacks that are not defined here.

                 dsx1InwardLoop
                  The transmitted signal at this interface is
                 looped back and received by the same interface.
                 What is transmitted onto the line is product
                 dependent.

                 dsx1DualLoop
                  Both dsx1LineLoop and dsx1InwardLoop will be
                 active simultaneously."
          ::= { dsx1ConfigEntry 9 }
```

```
          dsx1LineStatus OBJECT-TYPE
               SYNTAX  INTEGER (1..131071)
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "This variable indicates the Line Status of the
                      interface.  It contains loopback, failure,
                      received 'alarm' and transmitted 'alarms
                      information.

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

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

                      If the dsx1loopbackState bit is set, the loopback
                      in effect 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
               8192     dsx1UnavailSigState   Near End in Unavailable Signal
                                              State
              16384     dsx1NetEquipOOS       Carrier Equipment Out of Service
              32768     dsx1RcvPayloadAIS     DS2 Payload AIS
              65536     dsx1Ds2PerfThreshold  DS2 Performance Threshold
                                              Exceeded"
               ::= { dsx1ConfigEntry 10 }

               dsx1SignalMode OBJECT-TYPE
                    SYNTAX  INTEGER {
                                none (1),
```

```
                    robbedBit (2),
                    bitOriented (3),
                    messageOriented (4),
                    other (5)
                  }
        MAX-ACCESS  read-write
        STATUS  current
        DESCRIPTION
          "'none' indicates that no bits are reserved for
          signaling on this channel.

          'robbedBit' indicates that DS1 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 DS1."
        ::= { dsx1ConfigEntry 11 }

    dsx1TransmitClockSource OBJECT-TYPE
        SYNTAX  INTEGER {
                    loopTiming(1),
                    localTiming(2),
                    throughTiming(3)
                  }
        MAX-ACCESS  read-write
        STATUS  current
        DESCRIPTION
          "The source of Transmit Clock.
           'loopTiming' indicates that the recovered re-
          ceive clock is used as the transmit clock.

           'localTiming' indicates that a local clock
          source is used or when an external clock is
          attached to the box containing the interface.

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

    dsx1Fdl OBJECT-TYPE
```

```
            SYNTAX  INTEGER (1..15)
            MAX-ACCESS  read-write
            STATUS  current
            DESCRIPTION
              "This bitmap describes the use of  the  facili-
              ties data link, and is the sum of the capabili-
              ties.  Set any bits that are appropriate:

              other(1),
              dsx1AnsiT1403(2),
              dsx1Att54016(4),
              dsx1FdlNone(8)

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

               'dsx1AnsiT1403' refers to the  FDL  exchange
              recommended by ANSI.

               'dsx1Att54016' refers to ESF FDL exchanges.

               'dsx1FdlNone' indicates that the device  does
              not use the FDL."
            ::= { dsx1ConfigEntry 13 }

        dsx1InvalidIntervals OBJECT-TYPE
            SYNTAX  INTEGER (0..96)
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of intervals for which no valid data
                   is available."
            ::= { dsx1ConfigEntry 14 }

        dsx1LineLength OBJECT-TYPE
            SYNTAX  INTEGER (0..64000)
            UNITS  "meters"
            MAX-ACCESS  read-write
            STATUS  current
            DESCRIPTION
                   "The length of the ds1 line in meters. This
                   objects provides information for line build out
                   circuitry.  This object is only useful if the
                   interface has configurable line build out
                   circuitry."
```

```
          ::= { dsx1ConfigEntry 15 }

     dsx1LineStatusLastChange OBJECT-TYPE
          SYNTAX  TimeStamp
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The value of MIB II's sysUpTime object at the
                 time this DS1 entered its current line status
                 state.  If the current state was entered prior to
                 the last re-initialization of the proxy-agent,
                 then this object contains a zero value."
          ::= { dsx1ConfigEntry 16 }

     dsx1LineStatusChangeTrapEnable  OBJECT-TYPE
          SYNTAX      INTEGER {
                         enabled(1),
                         disabled(2)
                      }
          MAX-ACCESS  read-write
          STATUS      current
          DESCRIPTION
                 "Indicates whether dsx1LineStatusChange traps
                 should be generated for this interface."
          DEFVAL { disabled }
          ::= { dsx1ConfigEntry 17 }

     dsx1LoopbackStatus  OBJECT-TYPE
          SYNTAX      INTEGER (1..127)
          MAX-ACCESS  read-only
          STATUS      current
          DESCRIPTION
                 "This variable represents the current state of the
                 loopback on the DS1 interface.  It contains
                 information about loopbacks established by a
                 manager and remotely from the far end.

                 The dsx1LoopbackStatus is a bit map represented as
                 a sum, therefore is can represent multiple
                 loopbacks simultaneously.

                 The various bit positions are:
                  1  dsx1NoLoopback
                  2  dsx1NearEndPayloadLoopback
                  4  dsx1NearEndLineLoopback
```

```
                8  dsx1NearEndOtherLoopback
               16  dsx1NearEndInwardLoopback
               32  dsx1FarEndPayloadLoopback
               64  dsx1FarEndLineLoopback"

        ::= { dsx1ConfigEntry 18 }

        dsx1Ds1ChannelNumber  OBJECT-TYPE
             SYNTAX      INTEGER (0..28)
             MAX-ACCESS  read-only
             STATUS      current
             DESCRIPTION
                    "This variable represents the channel number of
                    the DS1/E1 on its parent Ds2/E2 or DS3/E3.  A
                    value of 0 indicated this DS1/E1 does not have a
                    parent DS3/E3."

        ::= { dsx1ConfigEntry 19 }

        dsx1Channelization  OBJECT-TYPE
             SYNTAX      INTEGER {
                            disabled(1),
                            enabledDs0(2),
                            enabledDs1(3)
                         }
             MAX-ACCESS  read-write
             STATUS      current
             DESCRIPTION
                    "Indicates whether this ds1/e1 is channelized or
                    unchannelized.  The value of enabledDs0 indicates
                    that this is a DS1 channelized into DS0s.  The
                    value of enabledDs1 indicated that this is a DS2
                    channelized into DS1s.  Setting this value will
                    cause the creation or deletion of entries in the
                    ifTable for the DS0s that are within the DS1."
        ::= { dsx1ConfigEntry 20 }
```

```
-- The DS1 Current Table
dsx1CurrentTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1CurrentEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "The DS1 current table contains various statistics
            being collected for the current 15 minute
            interval."
     ::= { ds1 7 }

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

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

dsx1CurrentIndex OBJECT-TYPE
     SYNTAX  InterfaceIndex
     MAX-ACCESS  read-only
     STATUS  current
     DESCRIPTION
            "The index value which uniquely identifies  the
            DS1 interface to which this entry is applicable.
            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  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                  "The number of Errored Seconds."
          ::= { dsx1CurrentEntry 2 }

     dsx1CurrentSESs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                  "The number of Severely Errored Seconds."
          ::= { dsx1CurrentEntry 3 }

     dsx1CurrentSEFSs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                  "The number of Severely Errored Framing Seconds."
          ::= { dsx1CurrentEntry 4 }

     dsx1CurrentUASs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                  "The number of Unavailable Seconds."
          ::= { dsx1CurrentEntry 5 }

     dsx1CurrentCSSs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                  "The number of Controlled Slip Seconds."
          ::= { dsx1CurrentEntry 6 }

     dsx1CurrentPCVs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
```

```
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Path Coding Violations."
            ::= { dsx1CurrentEntry 7 }

        dsx1CurrentLESs OBJECT-TYPE
            SYNTAX  PerfCurrentCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Line Errored Seconds."
            ::= { dsx1CurrentEntry 8 }

        dsx1CurrentBESs OBJECT-TYPE
            SYNTAX PerfCurrentCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                   "The number of Bursty Errored Seconds."
            ::= { dsx1CurrentEntry 9 }

        dsx1CurrentDMs OBJECT-TYPE
            SYNTAX PerfCurrentCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                   "The number of Degraded Minutes."
            ::= { dsx1CurrentEntry 10 }

        dsx1CurrentLCVs OBJECT-TYPE
            SYNTAX PerfCurrentCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                   "The number of Line Code Violations (LCVs)."
            ::= { dsx1CurrentEntry 11 }
```

```
-- The DS1 Interval Table
dsx1IntervalTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1IntervalEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "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.  Each row in this table represents one
            such interval (identified by dsx1IntervalNumber)
            for one specific instance (identified by
            dsx1IntervalIndex)."
     ::= { ds1 8 }

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

Dsx1IntervalEntry ::=
     SEQUENCE {
         dsx1IntervalIndex            InterfaceIndex,
         dsx1IntervalNumber           INTEGER,
         dsx1IntervalESs              PerfIntervalCount,
         dsx1IntervalSESs             PerfIntervalCount,
         dsx1IntervalSEFSs            PerfIntervalCount,
         dsx1IntervalUASs             PerfIntervalCount,
         dsx1IntervalCSSs             PerfIntervalCount,
         dsx1IntervalPCVs             PerfIntervalCount,
         dsx1IntervalLESs             PerfIntervalCount,
         dsx1IntervalBESs             PerfIntervalCount,
         dsx1IntervalDMs              PerfIntervalCount,
         dsx1IntervalLCVs             PerfIntervalCount,
         dsx1IntervalValidData        TruthValue
}

dsx1IntervalIndex OBJECT-TYPE
     SYNTAX  InterfaceIndex
     MAX-ACCESS  read-only
```

```
            STATUS  current
            DESCRIPTION
                    "The index value which uniquely identifies the DS1
                    interface to which this entry is applicable.  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)
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                    "A number between 1 and 96, where 1 is the most
                    recently completed 15 minute interval and 96 is
                    the 15 minutes interval completed 23 hours and 45
                    minutes prior to interval 1."
            ::= { dsx1IntervalEntry 2 }

        dsx1IntervalESs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                    "The number of Errored Seconds."
            ::= { dsx1IntervalEntry 3 }

        dsx1IntervalSESs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                    "The number of Severely Errored Seconds."
            ::= { dsx1IntervalEntry 4 }

        dsx1IntervalSEFSs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                    "The number of Severely Errored Framing Seconds."
            ::= { dsx1IntervalEntry 5 }

        dsx1IntervalUASs OBJECT-TYPE
```

```
               SYNTAX  PerfIntervalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Unavailable Seconds.  This object
                      may decrease if the occurance of unavailable
                      seconds occurs across an inteval boundary."
               ::= { dsx1IntervalEntry 6 }

          dsx1IntervalCSSs OBJECT-TYPE
               SYNTAX  PerfIntervalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Controlled Slip Seconds."
               ::= { dsx1IntervalEntry 7 }

          dsx1IntervalPCVs OBJECT-TYPE
               SYNTAX  PerfIntervalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Path Coding Violations."
               ::= { dsx1IntervalEntry 8 }

          dsx1IntervalLESs OBJECT-TYPE
               SYNTAX  PerfIntervalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Line Errored Seconds."
               ::= { dsx1IntervalEntry 9 }

          dsx1IntervalBESs OBJECT-TYPE
               SYNTAX PerfIntervalCount
               MAX-ACCESS read-only
               STATUS current
               DESCRIPTION
                      "The number of Bursty Errored Seconds."
               ::= { dsx1IntervalEntry 10 }

          dsx1IntervalDMs OBJECT-TYPE
               SYNTAX PerfIntervalCount
               MAX-ACCESS read-only
               STATUS current
```

```
              DESCRIPTION
                     "The number of Degraded Minutes."
              ::= { dsx1IntervalEntry 11 }

          dsx1IntervalLCVs OBJECT-TYPE
              SYNTAX PerfIntervalCount
              MAX-ACCESS read-only
              STATUS current
              DESCRIPTION
                     "The number of Line Code Violations."
              ::= { dsx1IntervalEntry 12 }

          dsx1IntervalValidData OBJECT-TYPE
              SYNTAX TruthValue
              MAX-ACCESS read-only
              STATUS current
              DESCRIPTION
                     "This variable indicates if there is valid data
                     for this interval."
              ::= { dsx1IntervalEntry 13 }
```

```
-- The DS1 Total Table
dsx1TotalTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1TotalEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "The DS1 Total Table contains the cumulative sum
            of the various statistics for the 24 hour period
            preceding the current interval."
     ::= { ds1 9 }

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

Dsx1TotalEntry ::=
     SEQUENCE {
         dsx1TotalIndex               InterfaceIndex,
         dsx1TotalESs                 PerfTotalCount,
         dsx1TotalSESs                PerfTotalCount,
         dsx1TotalSEFSs               PerfTotalCount,
         dsx1TotalUASs                PerfTotalCount,
         dsx1TotalCSSs                PerfTotalCount,
         dsx1TotalPCVs                PerfTotalCount,
         dsx1TotalLESs                PerfTotalCount,
         dsx1TotalBESs                PerfTotalCount,
         dsx1TotalDMs                 PerfTotalCount,
         dsx1TotalLCVs                PerfTotalCount
}

dsx1TotalIndex OBJECT-TYPE
     SYNTAX  InterfaceIndex
     MAX-ACCESS  read-only
     STATUS  current
     DESCRIPTION
            "The index value which uniquely identifies the DS1
            interface to which this entry is applicable.  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  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The sum of Errored Seconds encountered by a DS1
                 interface in the previous 24 hour interval.
                 Invalid 15 minute intervals count as 0."
          ::= { dsx1TotalEntry 2 }

     dsx1TotalSESs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Severely Errored Seconds
                 encountered by a DS1 interface in the previous 24
                 hour interval.  Invalid 15 minute intervals count
                 as 0."
          ::= { dsx1TotalEntry 3 }

     dsx1TotalSEFSs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Severely Errored Framing Seconds
                 encountered by a DS1 interface in the previous 24
                 hour interval.  Invalid 15 minute intervals count
                 as 0."
          ::= { dsx1TotalEntry 4 }

     dsx1TotalUASs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Unavailable Seconds encountered by
                 a DS1 interface in the previous 24 hour interval.
                 Invalid 15 minute intervals count as 0."
          ::= { dsx1TotalEntry 5 }

     dsx1TotalCSSs OBJECT-TYPE
```

```
            SYNTAX  PerfTotalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                  "The number of Controlled Slip Seconds encountered
                  by a DS1 interface in the previous 24 hour
                  interval.  Invalid 15 minute intervals count as
                  0."
            ::= { dsx1TotalEntry 6 }

      dsx1TotalPCVs OBJECT-TYPE
            SYNTAX  PerfTotalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                  "The number of Path Coding Violations encountered
                  by a DS1 interface in the previous 24 hour
                  interval.  Invalid 15 minute intervals count as
                  0."
            ::= { dsx1TotalEntry 7 }

      dsx1TotalLESs OBJECT-TYPE
            SYNTAX  PerfTotalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                  "The number of Line Errored Seconds encountered by
                  a DS1 interface in the previous 24 hour interval.
                  Invalid 15 minute intervals count as 0."
            ::= { dsx1TotalEntry 8 }

      dsx1TotalBESs OBJECT-TYPE
            SYNTAX PerfTotalCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                  "The number of Bursty Errored Seconds (BESs)
                  encountered by a DS1 interface in the previous 24
                  hour interval. Invalid 15 minute intervals count
                  as 0."
            ::= { dsx1TotalEntry 9 }

      dsx1TotalDMs OBJECT-TYPE
            SYNTAX PerfTotalCount
            MAX-ACCESS read-only
```

```
            STATUS current
            DESCRIPTION
                  "The number of Degraded Minutes (DMs) encountered
                  by a DS1 interface in the previous 24 hour
                  interval.  Invalid 15 minute intervals count as
                  0."
            ::= { dsx1TotalEntry 10 }

      dsx1TotalLCVs OBJECT-TYPE
            SYNTAX PerfTotalCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                  "The number of Line Code Violations (LCVs)
                  encountered by a DS1 interface in the current 15
                  minute interval.  Invalid 15 minute intervals
                  count as 0."
            ::= { dsx1TotalEntry 11 }
```

```
-- The DS1 Channel Table
dsx1ChanMappingTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1ChanMappingEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "The DS1 Channel Mapping table.  This table maps a
            DS1 channel number on a particular DS3 into an
            ifIndex.  In the presence of DS2s, this table can
            be used to map a DS2 channel number on a DS3 into
            an ifIndex, or used to map a DS1 channel number on
            a DS2 onto an ifIndex."
     ::= { ds1 16 }

dsx1ChanMappingEntry OBJECT-TYPE
     SYNTAX  Dsx1ChanMappingEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "An entry in the DS1 Channel Mapping table.  There
            is an entry in this table corresponding to each
            ds1 ifEntry within any interface that is
            channelized to the individual ds1 ifEntry level.

            This table is intended to facilitate mapping from
            channelized interface / channel number to DS1
            ifEntry.  (e.g. mapping (DS3 ifIndex, DS1 Channel
            Number) -> ifIndex)

            While this table provides information that can
            also be found in the ifStackTable and
            dsx1ConfigTable, it provides this same information
            with a single table lookup, rather than by walking
            the ifStackTable to find the various constituent
            ds1 ifTable entries, and testing various
            dsx1ConfigTable entries to check for the entry
            with the applicable DS1 channel number."
     INDEX   { ifIndex, dsx1Ds1ChannelNumber }
     ::= { dsx1ChanMappingTable 1 }

Dsx1ChanMappingEntry ::=
     SEQUENCE {
         dsx1ChanMappedIfIndex  InterfaceIndex
}
```

```
          dsx1ChanMappedIfIndex OBJECT-TYPE
               SYNTAX  InterfaceIndex
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "This object indicates the ifIndex value assigned
                      by the agent for the individual ds1 ifEntry that
                      corresponds to the given DS1 channel number
                      (specified by the INDEX element
                      dsx1Ds1ChannelNumber) of the given channelized
                      interface (specified by INDEX element ifIndex)."
               ::= { dsx1ChanMappingEntry 1 }
```

```
-- The DS1 Far End Current Table

dsx1FarEndCurrentTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1FarEndCurrentEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "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."
     ::= { ds1 10 }

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

Dsx1FarEndCurrentEntry ::=
     SEQUENCE {
         dsx1FarEndCurrentIndex      InterfaceIndex,
         dsx1FarEndTimeElapsed       INTEGER,
         dsx1FarEndValidIntervals    INTEGER,
         dsx1FarEndCurrentESs        PerfCurrentCount,
         dsx1FarEndCurrentSESs       PerfCurrentCount,
         dsx1FarEndCurrentSEFSs      PerfCurrentCount,
         dsx1FarEndCurrentUASs       PerfCurrentCount,
         dsx1FarEndCurrentCSSs       PerfCurrentCount,
         dsx1FarEndCurrentLESs       PerfCurrentCount,
         dsx1FarEndCurrentPCVs       PerfCurrentCount,
         dsx1FarEndCurrentBESs       PerfCurrentCount,
         dsx1FarEndCurrentDMs        PerfCurrentCount,
         dsx1FarEndInvalidIntervals  INTEGER
}

dsx1FarEndCurrentIndex OBJECT-TYPE
     SYNTAX  InterfaceIndex
     MAX-ACCESS  read-only
     STATUS  current
```

```
            DESCRIPTION
                  "The index value which uniquely identifies the DS1
                  interface to which this entry is applicable.  The
                  interface identified by a particular value of this
                  index is identical to the interface identified by
                  the same value of dsx1LineIndex."
            ::= { dsx1FarEndCurrentEntry 1 }

      dsx1FarEndTimeElapsed OBJECT-TYPE
            SYNTAX  INTEGER (0..899)
            MAX-ACCESS  read-only
            STATUS  current
            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)
            MAX-ACCESS  read-only
            STATUS  current
            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  PerfCurrentCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                  "The number of Far End Errored Seconds."
            ::= { dsx1FarEndCurrentEntry 4 }

      dsx1FarEndCurrentSESs OBJECT-TYPE
            SYNTAX  PerfCurrentCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                  "The number of Far End Severely Errored Seconds."
```

```
          ::= { dsx1FarEndCurrentEntry 5 }

     dsx1FarEndCurrentSEFSs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Severely Errored Framing
                 Seconds."
          ::= { dsx1FarEndCurrentEntry 6 }

     dsx1FarEndCurrentUASs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Unavailable Seconds."
          ::= { dsx1FarEndCurrentEntry 7 }

     dsx1FarEndCurrentCSSs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Controlled Slip Seconds."
          ::= { dsx1FarEndCurrentEntry 8 }

     dsx1FarEndCurrentLESs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Line Errored Seconds."
          ::= { dsx1FarEndCurrentEntry 9 }

     dsx1FarEndCurrentPCVs OBJECT-TYPE
          SYNTAX  PerfCurrentCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Path Coding Violations."
          ::= { dsx1FarEndCurrentEntry 10 }

     dsx1FarEndCurrentBESs OBJECT-TYPE
          SYNTAX PerfCurrentCount
```

```
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                   "The number of Far End Bursty Errored Seconds."
            ::= { dsx1FarEndCurrentEntry 11 }

      dsx1FarEndCurrentDMs OBJECT-TYPE
            SYNTAX PerfCurrentCount
            MAX-ACCESS read-only
            STATUS current
            DESCRIPTION
                   "The number of Far End Degraded Minutes."
            ::= { dsx1FarEndCurrentEntry 12 }

      dsx1FarEndInvalidIntervals OBJECT-TYPE
            SYNTAX  INTEGER (0..96)
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of intervals for which no valid data
                   is available."
            ::= { dsx1FarEndCurrentEntry 13 }

      -- The DS1 Far End Interval Table
      dsx1FarEndIntervalTable OBJECT-TYPE
            SYNTAX  SEQUENCE OF Dsx1FarEndIntervalEntry
            MAX-ACCESS  not-accessible
            STATUS  current
            DESCRIPTION
                   "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. Each row in this table represents one
                   such interval (identified by
                   dsx1FarEndIntervalNumber) for one specific
                   instance (identified by dsx1FarEndIntervalIndex)."
            ::= { ds1 11 }

      dsx1FarEndIntervalEntry OBJECT-TYPE
            SYNTAX  Dsx1FarEndIntervalEntry
            MAX-ACCESS  not-accessible
            STATUS  current
            DESCRIPTION
                   "An entry in the DS1 Far End Interval table."
```

```
        INDEX   { dsx1FarEndIntervalIndex,
                  dsx1FarEndIntervalNumber }
        ::= { dsx1FarEndIntervalTable 1 }

    Dsx1FarEndIntervalEntry ::=
        SEQUENCE {
            dsx1FarEndIntervalIndex       InterfaceIndex,
            dsx1FarEndIntervalNumber      INTEGER,
            dsx1FarEndIntervalESs         PerfIntervalCount,
            dsx1FarEndIntervalSESs        PerfIntervalCount,
            dsx1FarEndIntervalSEFSs       PerfIntervalCount,
            dsx1FarEndIntervalUASs        PerfIntervalCount,
            dsx1FarEndIntervalCSSs        PerfIntervalCount,
            dsx1FarEndIntervalLESs        PerfIntervalCount,
            dsx1FarEndIntervalPCVs        PerfIntervalCount,
            dsx1FarEndIntervalBESs        PerfIntervalCount,
            dsx1FarEndIntervalDMs         PerfIntervalCount,
            dsx1FarEndIntervalValidData   TruthValue
    }

    dsx1FarEndIntervalIndex OBJECT-TYPE
        SYNTAX  InterfaceIndex
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
                "The index value which uniquely identifies the DS1
                interface to which this entry is applicable.  The
                interface identified by a particular value of this
                index is identical to the interface identified by
                the same value of dsx1LineIndex."
        ::= { dsx1FarEndIntervalEntry 1 }

    dsx1FarEndIntervalNumber OBJECT-TYPE
        SYNTAX  INTEGER (1..96)
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
                "A number between 1 and 96, where 1 is the most
                recently completed 15 minute interval and 96 is
                the 15 minutes interval completed 23 hours and 45
                minutes prior to interval 1."
        ::= { dsx1FarEndIntervalEntry 2 }

    dsx1FarEndIntervalESs OBJECT-TYPE
        SYNTAX  PerfIntervalCount
```

```
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Far End Errored Seconds."
            ::= { dsx1FarEndIntervalEntry 3 }

        dsx1FarEndIntervalSESs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Far End Severely Errored Seconds."
            ::= { dsx1FarEndIntervalEntry 4 }

        dsx1FarEndIntervalSEFSs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Far End Severely Errored Framing
                   Seconds."
            ::= { dsx1FarEndIntervalEntry 5 }

        dsx1FarEndIntervalUASs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Unavailable Seconds."
            ::= { dsx1FarEndIntervalEntry 6 }

        dsx1FarEndIntervalCSSs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Far End Controlled Slip Seconds."
            ::= { dsx1FarEndIntervalEntry 7 }

        dsx1FarEndIntervalLESs OBJECT-TYPE
            SYNTAX  PerfIntervalCount
            MAX-ACCESS  read-only
            STATUS  current
            DESCRIPTION
                   "The number of Far End Line Errored Seconds."
```

```
          ::= { dsx1FarEndIntervalEntry 8 }

     dsx1FarEndIntervalPCVs OBJECT-TYPE
          SYNTAX  PerfIntervalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Path Coding Violations."
          ::= { dsx1FarEndIntervalEntry 9 }

     dsx1FarEndIntervalBESs OBJECT-TYPE
          SYNTAX PerfIntervalCount
          MAX-ACCESS read-only
          STATUS current
          DESCRIPTION
                 "The number of Far End Bursty Errored Seconds."
          ::= { dsx1FarEndIntervalEntry 10 }

     dsx1FarEndIntervalDMs OBJECT-TYPE
          SYNTAX PerfIntervalCount
          MAX-ACCESS read-only
          STATUS current
          DESCRIPTION
                 "The number of Far End Degraded Minutes."
          ::= { dsx1FarEndIntervalEntry 11 }

     dsx1FarEndIntervalValidData OBJECT-TYPE
          SYNTAX TruthValue
          MAX-ACCESS read-only
          STATUS current
          DESCRIPTION
                 "This variable indicates if there is valid data
                 for this interval."
          ::= { dsx1FarEndIntervalEntry 12 }
```

```
-- The DS1 Far End Total Table

dsx1FarEndTotalTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1FarEndTotalEntry
     MAX-ACCESS  not-accessible
     STATUS  current
     DESCRIPTION
            "The DS1 Far End Total Table contains the
            cumulative sum of the various statistics for the
            24 hour period preceding the current interval."
     ::= { ds1 12 }

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

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

dsx1FarEndTotalIndex OBJECT-TYPE
     SYNTAX  InterfaceIndex
     MAX-ACCESS  read-only
     STATUS  current
     DESCRIPTION
            "The index value which uniquely identifies the DS1
            interface to which this entry is applicable.  The
            interface identified by a particular value of this
            index is identical to the interface identified by
            the same value of dsx1LineIndex."
```

```
          ::= { dsx1FarEndTotalEntry 1 }

     dsx1FarEndTotalESs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Errored Seconds encountered
                 by a DS1 interface in the previous 24 hour
                 interval.  Invalid 15 minute intervals count as
                 0."
          ::= { dsx1FarEndTotalEntry 2 }

     dsx1FarEndTotalSESs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Severely Errored Seconds
                 encountered by a DS1 interface in the previous 24
                 hour interval.  Invalid 15 minute intervals count
                 as 0."
          ::= { dsx1FarEndTotalEntry 3 }

     dsx1FarEndTotalSEFSs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Far End Severely Errored Framing
                 Seconds encountered by a DS1 interface in the
                 previous 24 hour interval. Invalid 15 minute
                 intervals count as 0."
          ::= { dsx1FarEndTotalEntry 4 }

     dsx1FarEndTotalUASs OBJECT-TYPE
          SYNTAX  PerfTotalCount
          MAX-ACCESS  read-only
          STATUS  current
          DESCRIPTION
                 "The number of Unavailable Seconds encountered by
                 a DS1 interface in the previous 24 hour interval.
                 Invalid 15 minute intervals count as 0."
          ::= { dsx1FarEndTotalEntry 5 }
```

```
          dsx1FarEndTotalCSSs OBJECT-TYPE
               SYNTAX  PerfTotalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Far End Controlled Slip Seconds
                      encountered by a DS1 interface in the previous 24
                      hour interval.  Invalid 15 minute intervals count
                      as 0."
               ::= { dsx1FarEndTotalEntry 6 }

          dsx1FarEndTotalLESs OBJECT-TYPE
               SYNTAX  PerfTotalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Far End Line Errored Seconds
                      encountered by a DS1 interface in the previous 24
                      hour interval.  Invalid 15 minute intervals count
                      as 0."
               ::= { dsx1FarEndTotalEntry 7 }

          dsx1FarEndTotalPCVs OBJECT-TYPE
               SYNTAX  PerfTotalCount
               MAX-ACCESS  read-only
               STATUS  current
               DESCRIPTION
                      "The number of Far End Path Coding Violations
                      reported via the far end block error count
                      encountered by a DS1 interface in the previous 24
                      hour interval.  Invalid 15 minute intervals count
                      as 0."
               ::= { dsx1FarEndTotalEntry 8 }

          dsx1FarEndTotalBESs OBJECT-TYPE
               SYNTAX PerfTotalCount
               MAX-ACCESS read-only
               STATUS current
               DESCRIPTION
                      "The number of Bursty Errored Seconds (BESs)
                      encountered by a DS1 interface in the previous 24
                      hour interval. Invalid 15 minute intervals count
                      as 0."
               ::= { dsx1FarEndTotalEntry 9 }
```

```
          dsx1FarEndTotalDMs OBJECT-TYPE
               SYNTAX PerfTotalCount
               MAX-ACCESS read-only
               STATUS current
               DESCRIPTION
                      "The number of Degraded Minutes (DMs) encountered
                      by a DS1 interface in the previous 24 hour
                      interval.  Invalid 15 minute intervals count as
                      0."
               ::= { dsx1FarEndTotalEntry 10 }
```

```
-- The DS1 Fractional Table
dsx1FracTable OBJECT-TYPE
     SYNTAX  SEQUENCE OF Dsx1FracEntry
     MAX-ACCESS  not-accessible
     STATUS  deprecated
     DESCRIPTION
            "This table is deprecated in favour of using
            ifStackTable.

            The table was mandatory for 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."
           ::= { ds1 13 }

        dsx1FracEntry OBJECT-TYPE
             SYNTAX  Dsx1FracEntry
             MAX-ACCESS  not-accessible
             STATUS  deprecated
             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)
            MAX-ACCESS  read-only
            STATUS  deprecated
            DESCRIPTION
               "The index value which uniquely identifies  the
               DS1  interface  to which this entry is applicable
               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)
          MAX-ACCESS  read-only
          STATUS  deprecated
          DESCRIPTION
             "The channel number for this entry."
         ::= { dsx1FracEntry 2 }

      dsx1FracIfIndex OBJECT-TYPE
          SYNTAX  INTEGER (1..'7fffffff'h)
          MAX-ACCESS  read-write
          STATUS  deprecated
          DESCRIPTION
             "An index value that uniquely identifies an
             interface.  The interface identified by a particular
             value of this index is the same  interface
             as  identified by the same value an ifIndex
             object instance. If no interface is currently using
             a channel, the value should be zero.  If a
             single interface occupies more  than  one  time
             slot,  that ifIndex value will be found in multiple
             time slots."
         ::= { dsx1FracEntry 3 }
```

```
          -- Ds1 TRAPS

          ds1Traps OBJECT IDENTIFIER ::= { ds1 15 }



          dsx1LineStatusChange NOTIFICATION-TYPE
              OBJECTS { dsx1LineStatus,
                        dsx1LineStatusLastChange }
              STATUS  current
              DESCRIPTION
                      "A dsx1LineStatusChange trap is sent when the
                      value of an instance dsx1LineStatus changes. It
                      can be utilized by an NMS to trigger polls.  When
                      the line status change results from a higher level
                      line status change (i.e. ds3), then no traps for
                      the ds1 are sent."
               ::= { ds1Traps 0 1 }
```

```
        -- conformance information
        ds1Conformance OBJECT IDENTIFIER ::= { ds1 14 }

        ds1Groups      OBJECT IDENTIFIER ::= { ds1Conformance 1 }
        ds1Compliances OBJECT IDENTIFIER ::= { ds1Conformance 2 }



        -- compliance statements

        ds1Compliance MODULE-COMPLIANCE
            STATUS  current
            DESCRIPTION
                    "The compliance statement for T1 and E1
                    interfaces."
            MODULE  -- this module
                MANDATORY-GROUPS { ds1NearEndConfigGroup,
                                   ds1NearEndStatisticsGroup }

                GROUP       ds1FarEndGroup
                DESCRIPTION
                    "Implementation of this group is optional for all
                    systems that attach to a DS1 Interface."

                GROUP       ds1NearEndOptionalConfigGroup
                DESCRIPTION
                    "Implementation of this group is optional for all
                    systems that attach to a DS1 Interface."

                GROUP       ds1DS2Group
                DESCRIPTION
                    "Implementation of this group is mandatory for all
                    systems that attach to a DS2 Interface."

                GROUP       ds1TransStatsGroup
                DESCRIPTION
                    "This group is the set of statistics appropriate
                    for all systems which attach to a DS1 Interface
                    running transparent or unFramed lineType."


                GROUP       ds1ChanMappingGroup
                DESCRIPTION
                    "This group is the set of objects for mapping a
                    DS3 Channel (ds1ChannelNumber) to ifIndex.
```

```
            Implementation of this group is mandatory for
            systems which support the channelization of DS3s
            into DS1s."

        OBJECT dsx1LineType
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the line type is not
            required."

        OBJECT dsx1LineCoding
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the line coding is not
            required."

        OBJECT dsx1SendCode
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the send code is not
            required."

        OBJECT dsx1LoopbackConfig
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set loopbacks is not required."

        OBJECT dsx1SignalMode
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the signal mode is not
            required."

        OBJECT dsx1TransmitClockSource
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the transmit clock source is
            not required."

        OBJECT dsx1Fdl
        MIN-ACCESS read-only
        DESCRIPTION
            "The ability to set the FDL is not required."

        OBJECT dsx1LineLength
```

```
                MIN-ACCESS read-only
                DESCRIPTION
                    "The ability to set the line length is not
                    required."

                OBJECT dsx1Channelization
                MIN-ACCESS read-only
                DESCRIPTION
                    "The ability to set the channelization is not
                    required."
            ::= { ds1Compliances 1 }

        ds1MibT1PriCompliance MODULE-COMPLIANCE
            STATUS current
            DESCRIPTION
                    "Compliance statement for using this MIB for ISDN
                    Primary Rate interfaces on T1 lines."
            MODULE
                MANDATORY-GROUPS { ds1NearEndConfigGroup,
                                   ds1NearEndStatisticsGroup }
                OBJECT dsx1LineType
                    SYNTAX INTEGER {
                        dsx1ESF(2)   -- Intl Spec would be G704(2)
                                     -- or I.431(4)
                    }
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "Line type for T1 ISDN Primary Rate
                         interfaces."

                OBJECT dsx1LineCoding
                    SYNTAX INTEGER {
                        dsx1B8ZS(2)
                    }
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "Type of Zero Code Suppression for
                         T1 ISDN Primary Rate interfaces."

                OBJECT dsx1SignalMode
                    SYNTAX INTEGER {
                        none(1), -- if there is no signaling channel
                        messageOriented(4)
                    }
                    MIN-ACCESS read-only
```

```
                    DESCRIPTION
                        "Possible signaling modes for
                         T1 ISDN Primary Rate interfaces."

                OBJECT dsx1TransmitClockSource
                    SYNTAX INTEGER {
                        loopTiming(1)
                    }
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "The transmit clock is derived from
                         received clock on ISDN Primary Rate
                         interfaces."

                OBJECT dsx1Fdl
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "Facilities Data Link usage on T1 ISDN
                         Primary Rate interfaces.
                         Note: Eventually dsx1Att-54016(4) is to be
                               used here since the line type is ESF."

                OBJECT dsx1Channelization
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "The ability to set the channelization
                         is not required."
            ::= { ds1Compliances 2 }


        ds1MibE1PriCompliance MODULE-COMPLIANCE
            STATUS current
            DESCRIPTION
                    "Compliance statement for using this MIB for ISDN
                    Primary Rate interfaces on E1 lines."
            MODULE
                MANDATORY-GROUPS { ds1NearEndConfigGroup,
                                   ds1NearEndStatisticsGroup }
                OBJECT dsx1LineType
                    SYNTAX INTEGER {
                        dsx1E1CRC(5)
                    }
                    MIN-ACCESS read-only
                    DESCRIPTION
                        "Line type for E1 ISDN Primary Rate
```

```
                interfaces."

            OBJECT dsx1LineCoding
                SYNTAX INTEGER {
                    dsx1HDB3(3)
                }
                MIN-ACCESS read-only
                DESCRIPTION
                    "Type of Zero Code Suppression for
                     E1 ISDN Primary Rate interfaces."

            OBJECT dsx1SignalMode
                SYNTAX INTEGER {
                    messageOriented(4)
                }
                MIN-ACCESS read-only
                DESCRIPTION
                    "Signaling on E1 ISDN Primary Rate interfaces
                     is always message oriented."

            OBJECT dsx1TransmitClockSource
                SYNTAX INTEGER {
                    loopTiming(1)
                }
                MIN-ACCESS read-only
                DESCRIPTION
                    "The transmit clock is derived from received
                     clock on ISDN Primary Rate interfaces."

            OBJECT dsx1Fdl
                MIN-ACCESS read-only
                DESCRIPTION
                    "Facilities Data Link usage on E1 ISDN
                     Primary Rate interfaces.
                     Note: There is a 'M-Channel' in E1,
                           using National Bit Sa4 (G704,
                           Table 4a). It is used to implement
                           management features between ET
                           and NT.  This is different to
                           FDL in T1, which is used to carry
                           control signals and performance
                           data.  In E1, control and status
                           signals are carried using National
                           Bits Sa5, Sa6 and A (RAI Ind.).
                     This indicates that only the other(1) or
```

```
                        eventually the dsx1Fdl-none(8) bits should
                        be set in this object for E1 PRI."

                OBJECT dsx1Channelization
                    MIN-ACCESS read-only
                    DESCRIPTION
                    "The ability to set the channelization is not
                    required."
            ::= { ds1Compliances 3 }


        ds1Ds2Compliance MODULE-COMPLIANCE
            STATUS current
            DESCRIPTION
                    "Compliance statement for using this MIB for DS2
                    interfaces."
            MODULE
                MANDATORY-GROUPS { ds1DS2Group }

                OBJECT dsx1Channelization
                    MIN-ACCESS read-only
                    DESCRIPTION
                    "The ability to set the channelization is not
                    required."
            ::= { ds1Compliances 4 }

        -- units of conformance

        ds1NearEndConfigGroup  OBJECT-GROUP
            OBJECTS { dsx1LineIndex,
                      dsx1TimeElapsed,
                      dsx1ValidIntervals,
                      dsx1LineType,
                      dsx1LineCoding,
                      dsx1SendCode,
                      dsx1CircuitIdentifier,
                      dsx1LoopbackConfig,
                      dsx1LineStatus,
                      dsx1SignalMode,
                      dsx1TransmitClockSource,
                      dsx1Fdl,
                      dsx1InvalidIntervals,
                      dsx1LineLength,
                      dsx1LoopbackStatus,
                      dsx1Ds1ChannelNumber,
```

```
                dsx1Channelization }
        STATUS  current
        DESCRIPTION
                "A collection of objects providing configuration
                information applicable to all DS1 interfaces."
        ::= { ds1Groups 1 }

    ds1NearEndStatisticsGroup OBJECT-GROUP
        OBJECTS { dsx1CurrentIndex,
                  dsx1CurrentESs,
                  dsx1CurrentSESs,
                  dsx1CurrentSEFSs,
                  dsx1CurrentUASs,
                  dsx1CurrentCSSs,
                  dsx1CurrentPCVs,
                  dsx1CurrentLESs,
                  dsx1CurrentBESs,
                  dsx1CurrentDMs,
                  dsx1CurrentLCVs,
                  dsx1IntervalIndex,
                  dsx1IntervalNumber,
                  dsx1IntervalESs,
                  dsx1IntervalSESs,
                  dsx1IntervalSEFSs,
                  dsx1IntervalUASs,
                  dsx1IntervalCSSs,
                  dsx1IntervalPCVs,
                  dsx1IntervalLESs,
                  dsx1IntervalBESs,
                  dsx1IntervalDMs,
                  dsx1IntervalLCVs,
                  dsx1IntervalValidData,
                  dsx1TotalIndex,
                  dsx1TotalESs,
                  dsx1TotalSESs,
                  dsx1TotalSEFSs,
                  dsx1TotalUASs,
                  dsx1TotalCSSs,
                  dsx1TotalPCVs,
                  dsx1TotalLESs,
                  dsx1TotalBESs,
                  dsx1TotalDMs,
                  dsx1TotalLCVs }
        STATUS  current
        DESCRIPTION
```

```
                "A collection of objects providing statistics
                information applicable to all DS1 interfaces."
            ::= { ds1Groups 2 }

        ds1FarEndGroup  OBJECT-GROUP
            OBJECTS { dsx1FarEndCurrentIndex,
                      dsx1FarEndTimeElapsed,
                      dsx1FarEndValidIntervals,
                      dsx1FarEndCurrentESs,
                      dsx1FarEndCurrentSESs,
                      dsx1FarEndCurrentSEFSs,
                      dsx1FarEndCurrentUASs,
                      dsx1FarEndCurrentCSSs,
                      dsx1FarEndCurrentLESs,
                      dsx1FarEndCurrentPCVs,
                      dsx1FarEndCurrentBESs,
                      dsx1FarEndCurrentDMs,
                      dsx1FarEndInvalidIntervals,
                      dsx1FarEndIntervalIndex,
                      dsx1FarEndIntervalNumber,
                      dsx1FarEndIntervalESs,
                      dsx1FarEndIntervalSESs,
                      dsx1FarEndIntervalSEFSs,
                      dsx1FarEndIntervalUASs,
                      dsx1FarEndIntervalCSSs,
                      dsx1FarEndIntervalLESs,
                      dsx1FarEndIntervalPCVs,
                      dsx1FarEndIntervalBESs,
                      dsx1FarEndIntervalDMs,
                      dsx1FarEndIntervalValidData,
                      dsx1FarEndTotalIndex,
                      dsx1FarEndTotalESs,
                      dsx1FarEndTotalSESs,
                      dsx1FarEndTotalSEFSs,
                      dsx1FarEndTotalUASs,
                      dsx1FarEndTotalCSSs,
                      dsx1FarEndTotalLESs,
                      dsx1FarEndTotalPCVs,
                      dsx1FarEndTotalBESs,
                      dsx1FarEndTotalDMs }
            STATUS  current
            DESCRIPTION
                    "A collection of objects providing remote
                    configuration and statistics information."
            ::= { ds1Groups 3 }
```

```
        ds1DeprecatedGroup OBJECT-GROUP
            OBJECTS { dsx1IfIndex,
                      dsx1FracIndex,
                      dsx1FracNumber,
                      dsx1FracIfIndex }
            STATUS  deprecated
            DESCRIPTION
                    "A collection of obsolete objects that may be
                    implemented for backwards compatibility."
            ::= { ds1Groups 4 }

        ds1NearEndOptionalConfigGroup OBJECT-GROUP
            OBJECTS { dsx1LineStatusLastChange,
                      dsx1LineStatusChangeTrapEnable }

            STATUS    current
            DESCRIPTION
                    "A collection of objects that may be implemented
                    on DS1 and DS2 interfaces."
            ::= { ds1Groups 5 }

        ds1DS2Group OBJECT-GROUP
            OBJECTS { dsx1LineIndex,
                      dsx1LineType,
                      dsx1LineCoding,
                      dsx1SendCode,
                      dsx1LineStatus,
                      dsx1SignalMode,
                      dsx1TransmitClockSource,
                      dsx1Channelization }
            STATUS   current
            DESCRIPTION
                    "A collection of objects providing information
                    about DS2 (6,312 kbps) and E2 (8,448 kbps)
                    systems."
            ::= { ds1Groups 6 }

        ds1TransStatsGroup OBJECT-GROUP
            OBJECTS { dsx1CurrentESs,
                      dsx1CurrentSESs,
                      dsx1CurrentUASs,
                      dsx1IntervalESs,
                      dsx1IntervalSESs,
                      dsx1IntervalUASs,
                      dsx1TotalESs,
```

```
                    dsx1TotalSESs,
                    dsx1TotalUASs }
        STATUS   current
        DESCRIPTION
                    "A collection of objects which are the
                statistics which can be collected from a ds1
                interface that is running transparent or unframed
                lineType.  Statistics not in this list should
                return noSuchInstance."
        ::= { ds1Groups 7 }

    ds1NearEndOptionalTrapGroup NOTIFICATION-GROUP
        NOTIFICATIONS { dsx1LineStatusChange }
        STATUS    current
        DESCRIPTION
                "A collection of notifications that may be
                implemented on DS1 and DS2 interfaces."
        ::= { ds1Groups 8 }

    ds1ChanMappingGroup OBJECT-GROUP
        OBJECTS { dsx1ChanMappedIfIndex }
        STATUS    current
        DESCRIPTION
                "A collection of objects that give an mapping of
                DS3 Channel (ds1ChannelNumber) to ifIndex."
        ::= { ds1Groups 9 }

    END
```

4. Appendix A - Use of dsx1IfIndex and dsx1LineIndex

This Appendix exists to document the previous use if dsx1IfIndex and dsx1LineIndex and to clarify the relationship of dsx1LineIndex as defined in rfc1406 with the dsx1LineIndex as defined in this document.

The following shows the old and new definitions and the relationship:

[New Definition]: "This object should be made equal to ifIndex. The next paragraph describes its previous usage. Making the object equal to ifIndex allows proper use of ifStackTable and ds0/ds0bundle mibs.

[Old Definition]: "This object is the identifier of 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 that is greater than ifNumber and numbering the inside interfaces (e.g., equipment side) with even numbers and outside interfaces (e.g, network side) with odd numbers."

When the "Old Definition" was created, it was described this way to allow a manager to treat the value _as if_ it were and ifIndex, i.e. the value would either be: 1) an ifIndex value or 2) a value that was guaranteed to be different from all valid ifIndex values.

The new definition is a subset of that definition, i.e. the value is always an ifIndex value.

The following is Section 3.1 from rfc1406:

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:

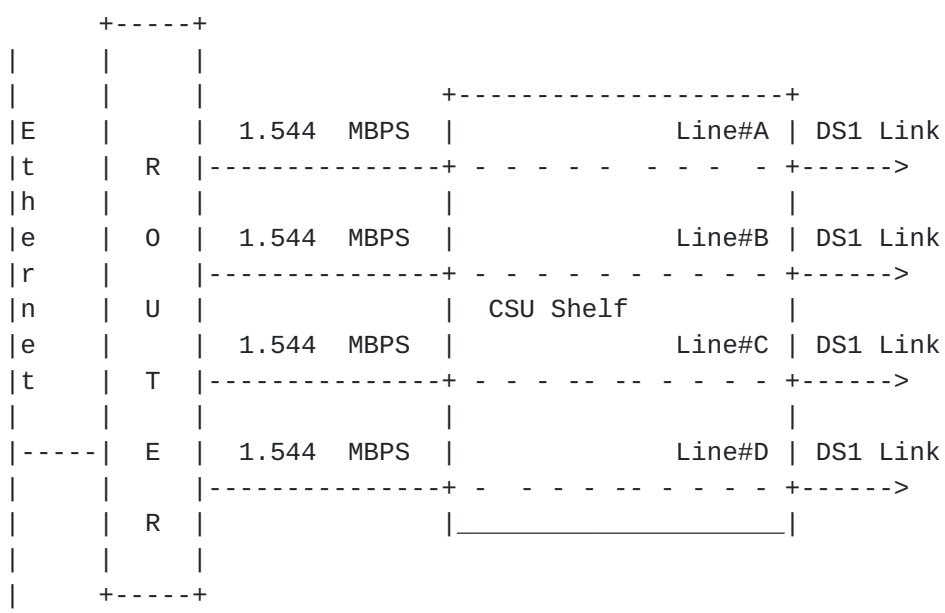
ifIndex=dsx1IfIndex=dsx1LineIndex for all interfaces.

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, RFC1213).

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:



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

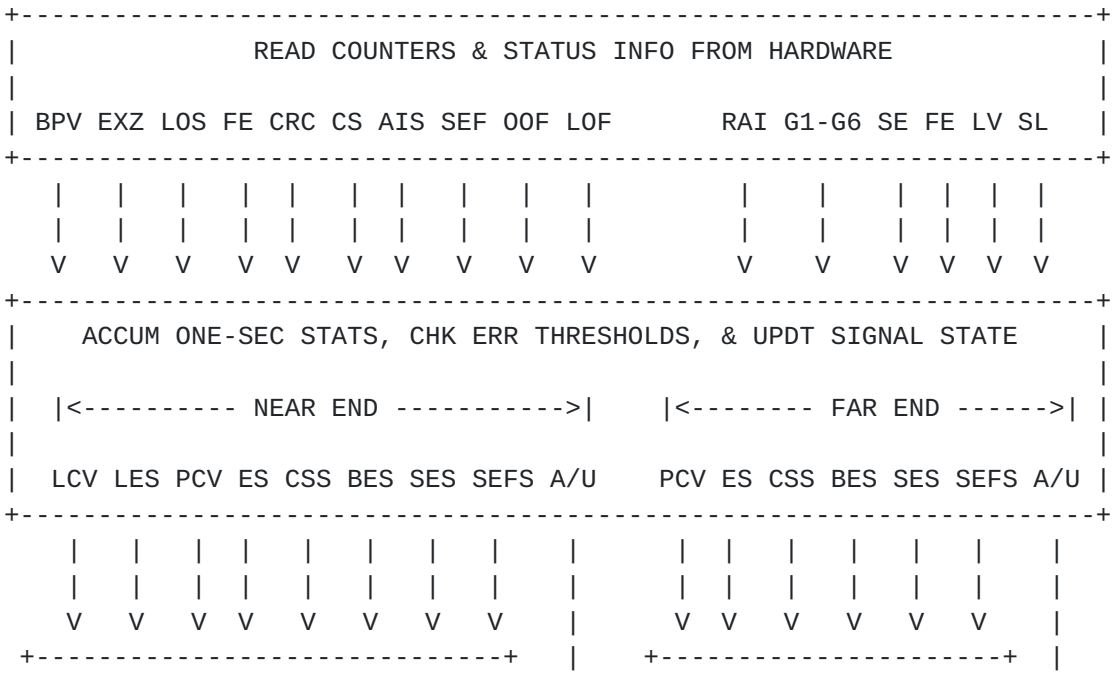
For this example, ifNumber is equal to 5. Note the following description of dsx1LineIndex: the dsx1LineIndex identifies a DS1 Interface on a managed device. If there is an ifEntry that is directly associated with this and only this DS1 interface, it should have the same value as ifIndex. Otherwise, number 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.

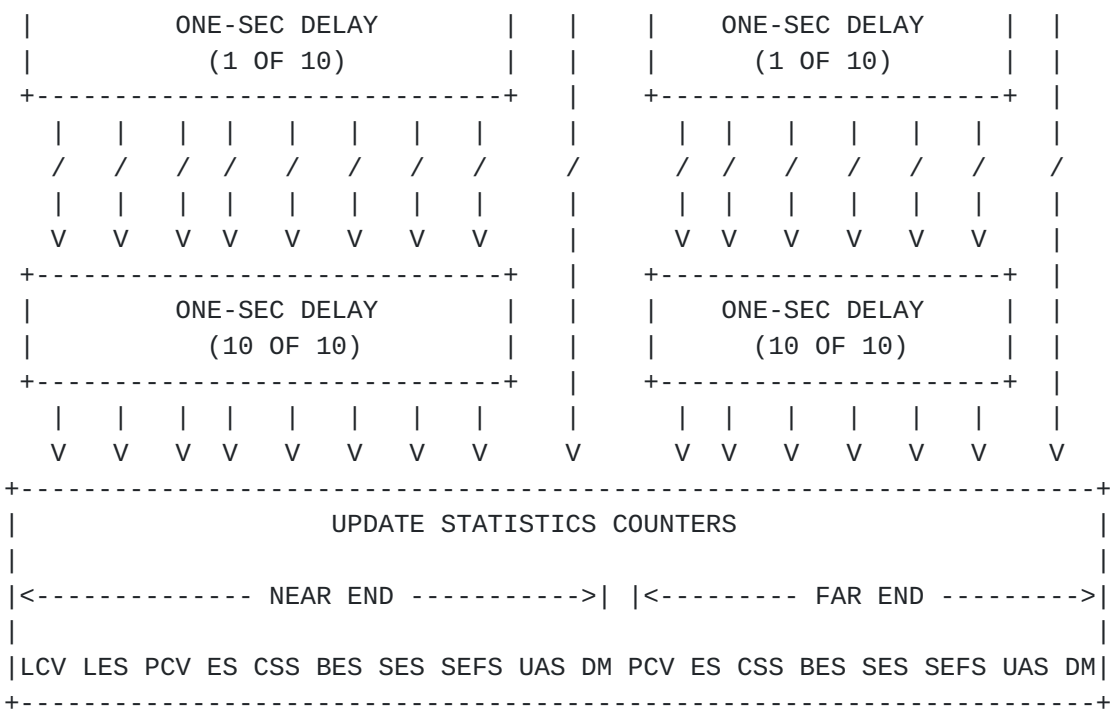
If the CSU shelf is managed by itself by a local SNMP Agent, the situation would be:

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

5. Appendix B - The delay approach to Unavialable Seconds.

This procedure is illustrated below for a DS1 ESF interface. Similar rules would apply for other DS1, DS2, and E1 interface variants. The procedure guarantees that the statistical counters are correctly updated at all times, although they lag real time by 10 seconds. At the end of each 15 minutes interval the current interval counts are transferred to the most recent interval entry and each interval is shifted up by one position, with the oldest being discarded if necessary in order to make room. The current interval counts then start over from zero. Note, however, that the signal state calculation does not start afresh at each interval boundary; rather, signal state information is retained across interval boundaries.





Note that if such a procedure is adopted there is no current interval data for the first ten seconds after a system comes up. noSuchInstance must be returned if a management station attempts to access the current interval counters during this time.

It is an implementation-specific matter whether an agent assumes that the initial state of the interface is available or unavailable.

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7. Acknowledgments

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8. References

[1] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", RFC 2271, Cabletron Systems, Inc., BMC Software, Inc., IBM T. J. Watson Research, January 1998

[2] Rose, M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", RFC 1155, Performance Systems International, Hughes LAN Systems, May 1990

[3] Rose, M., and K. McCloghrie, "Concise MIB Definitions", RFC 1212, Performance Systems International, Hughes LAN Systems, March 1991

[4] M. Rose, "A Convention for Defining Traps for use with the SNMP", RFC 1215, Performance Systems International, March 1991

[5] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1902, SNMP Research,Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[6] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1903, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[7] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Conformance Statements for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1904, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[8] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", RFC 1157, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.

[9] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[10] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[11] Case, J., Harrington D., Presuhn R., and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2272, SNMP Research, Inc., Cabletron Systems, Inc., BMC Software, Inc., IBM T. J. Watson Research, January 1998.

[12] Blumenthal, U., and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2274, IBM T. J. Watson Research, January 1998.

[13] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[14] Levi, D., Meyer, P., and B. Stewart, "SNMPv3 Applications", RFC 2273, SNMP Research, Inc., Secure Computing Corporation, Cisco Systems, January 1998

[15] Wijnen, B., Presuhn, R., and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", RFC 2275, IBM T. J. Watson Research, BMC Software, Inc., Cisco Systems, Inc., January 1998

[16] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB using SMIv2", RFC 2233, Cisco Systems, FTP Software, November 1997.

[17] AT&T Information Systems, AT&T ESF DS1 Channel Service Unit User's Manual, 999-100-305, February 1988.

[18] AT&T Technical Reference, Requirements for Interfacing Digital Terminal Equipment to Services Employing the Extended Superframe Format, Publication 54016, May 1988.

[19] American National Standard for Telecommunications -- Carrier-to-Customer Installation - DS1 Metallic Interface, T1.403, February 1989.

[20] CCITT Specifications Volume III, Recommendation G.703, Physical/Electrical Characteristics of Hierarchical Digital Interfaces, April 1991.

[21] ITU-T G.704: Synchronous frame structures used at 1544, 6312, 2048, 8488 and 44 736 kbit/s Hierarchical Levels, July 1995.

[22] American National Standard for Telecommunications -- Digital Hierarchy -- Layer 1 In-Service Digital Transmission Performace Monitoring, T1.231, Sept 1993.

[23] CCITT Specifications Volume IV, Recommendation O.162, Equipment To Perform In Service Monitoring On 2048 kbit/s Signals, July 1988.

[24] CCITT Specifications Volume III, Recommendation G.821, Error Performance Of An International Digital Connection Forming Part Of An Integrated Services Digital Network, July 1988.

[25] AT&T Technical Reference, Technical Reference 62411, ACCUNET T1.5 Service Description And Interface Specification, December 1990.

[26] CCITT Specifications Volume III, Recommendation G.706, Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704, July 1988.

[27] CCITT Specifications Volume III, Recommendation G.732, Characteristics Of Primary PCM Multiplex Equipment Operating at 2048 kbit/s, July 1988.

[28] Fowler, D., "Definitions of Managed Objects for the DS3/E3 Interface Types", draft-ietf-trunkmib-ds3-mib-09.txt, Newbridge Networks, August 1998.

[29] Brown, T., and Tesink, K., "Definitions of Managed Objects for the SONET/SDH Interface Type", draft-ietf-atommib-sonetng-02.txt, Bell Communications Research, August 1996.

[30] Fowler, D., "Definitions of Managed Objects for the Ds0 and DS0Bundle Interface Types", draft-ietf-trunkmib-ds0-mib-07.txt, Newbridge Networks, July 1998.

[31] ITU-T G.775: Loss of signal (LOS) and alarm indication signal (AIS) defect detection and clearance criteria, May 1995.

[32] ITU-T G.826: Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate, November 1993.

[33] American National Standard for Telecommunications -- Digital Hierarchy - Electrical Interfaces, T1.102, December 1993.

[34] American National Standard for Telecommunications -- Digital Hierarchy - Format Specifications, T1.107, August 1988.

[35] Tesink, K., lqTextual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals", draft-ietf-atommib-perfhistTC-01.txt, Bell Communications Research, October 1996.

9. Security Considerations

SNMPv1 by itself is such an insecure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET (read) the objects in this MIB.

It is recommended that the implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2274 [12] and the View-based Access Control Model RFC 2275 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to those objects only to those principals (users) that have legitimate rights to access them.

Setting any of the following objects to an inappropriate value can cause loss of traffic. The definition of inappropriate varies for each object. In the case of dsx1LineType, for example, both ends of a ds1/e1 must have the same value in order for traffic to flow. In the case of dsx1SendCode and dsx1LoopbackConfig, for another example, traffic may stop transmitting when particular loopbacks are applied.

- dsx1LineType
- dsx1LineCoding
- dsx1SendCode
- dsx1LoopbackConfig
- dsx1SignalMode
- dsx1TransmitClockSource
- dsx1Fdl
- dsx1LineLength
- dsx1Channelization

Setting the following object is mischevious, but not harmful to traffic

- dsx1CircuitIdentifier

Setting the following object can cause an increase in the number of traps received by the network management station.

- dsx1LineStatusChangeTrabEnable

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