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Request for Comments: 5604   RADVISION Ltd.
Category: Standards Track   July 2009

               Managed Objects for Time Division Multiplexing (TDM)
                      over Packet Switched Networks (PSNs)

Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in the Internet community.
   In particular, it describes managed objects for pseudowire
   encapsulation for structured or unstructured Time-Division
   Multiplexing (TDM) (T1, E1, T3, E3) circuits over a Packet Switched
   Network (PSN).

Status of This Memo

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

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1. Introduction

   This document describes a model for managing TDM pseudowires, i.e.,
   TDM data encapsulated for transmission over a Packet Switched Network
   (PSN). The term TDM in this document is limited to the scope of
   Plesiochronous Digital Hierarchy (PDH). It is currently specified to
   carry any TDM Signals in either Structure Agnostic Transport mode
   (E1, T1, E3, and T3) or in Structure Aware Transport mode (E1, T1,
   and NxDS0) as defined in the Pseudowire Emulation Edge-to-Edge (PWE3)
   TDM Requirements document [RFC4197].

   This document is closely related to [SATOP], [TDMOIP], and [CESOPSN],
   which describe the encapsulation of TDM signals and provide the
   Circuit Emulation Service over a PSN.

   The TDM management model consists of several MIB modules, following
   the layering model described in the PWE3 Architecture document
   [RFC3985]. The TDM MIB module described in this document works
   closely with the MIB modules described in [DS3MIB], [DS1MIB],
   [DS0MIB], [IFMIB], [PWMIB], and with the textual conventions defined
   in [PWTC]. The conceptual layering and relationship among all those
   is described in Figure 1 below. A TDM connection will be a
   pseudowire (PW) connection. It will not be treated as an interface
   and will therefore not be represented in the ifTable.

Figure 1: Conceptual Layering

```
                 +------------------+
                 |     TDM MIB      |  DS1MIB, DS3MIB,
                 +------------------+  DS0MIB
                         |
                 +------------------+  PW-TDM-MIB,
      Service    |    TDM PW MIB    |  PW-CESOPSN-MIB,
       Layer     +------------------+  PW-TDMOIP-MIB


    - - - - - - - - - - - |- - - - - - - - - - - - - -
      Generic    +------------------+
        PW       | Generic PW MIBS  |  PW-TC-MIB,
       Layer     +------------------+  PW-MIB
    - - - - - - - - - - - -|- - - - - - - - - - - - - -
                 +------------------+
      PSN VC     |   MPLS VC MIBS   |  PW-MPLS-MIB
       Layer     +------------------+
    - - - - - - - - - - - -|- - - - - - - - - - - - - -
                 +------------------+
        PSN      |    MPLS MIBs     |  MPLS-TE-STD-MIB,
       Layer     +------------------+  MPLS-LSR-STD-MIB
```
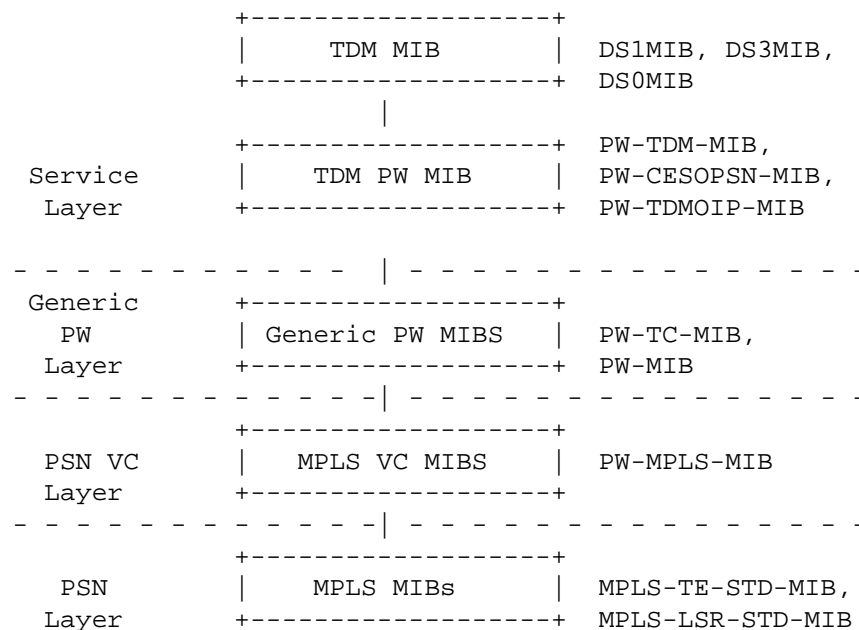
2. Conventions

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [BCP14].

3. Terminology

   The basic terminology used to refer to transmission direction in this
   document is taken from [SATOP], which describes a mechanism for
   transporting Structure-Agnostic (TDM) bit-streams over a packet-
   oriented network. To simplify this document, the terminology is used
   for structured and unstructured TDM as well.

   "PSN-bound" references the traffic direction where TDM data is
   received, adapted to the packet based on the number of payload bytes
   per packet, assigned a relevant TDM header (sequence numbers, flags,
   and timestamps (if the RTP header is used)), prepended multiplexing
   layer and PSN headers, and sent into the PSN.

   Conversely, the "CE-bound" references the traffic direction where
   packets are received from the PSN, packet payloads are reassembled by
   including a jitter buffer where payload of the received TDM packets

is stored prior to play out to the TDM line. The size of this buffer
SHOULD be locally configurable to allow accommodation to the PSN-
specific packet delay variation.

The CE-bound TDM interworking function (IWF) SHOULD use the sequence
number in the control word for the detection of lost (Loss of Packet
State (LOPS)) and mis-ordered packets. If the RTP header is used,
the RTP sequence numbers MAY be used for the same purposes.

4. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current
Internet-Standard Management Framework, please refer to section 7 of
RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed
the Management Information Base or MIB. MIB objects are generally
accessed through the Simple Network Management Protocol (SNMP).

Objects in the MIB are defined using the mechanisms defined in the
Structure of Management Information (SMI). This memo specifies a MIB
module that is compliant to the SMIv2, which is described in STD 58,
RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580
[RFC2580].

5. Overview

This MIB module is designed to satisfy the following requirements and
constraints:

1. Fit within the architecture defined by [RFC3985] and [PWMIB].

2. Support edge-to-edge emulation of any TDM connections.

3. Configure the connection. The connection-specific behavior is
    provided via the supplement MIB modules.

4. Report various alarms, counters, and status objects.

6. TDM MIB Module Usage

6.1. Structure of TDM MIB

The MIB consists of five tables;

- The TDM PW Table (pwTDMTable) contains generic TDM information
  regarding the PW connection. It contains the ifIndex of the TDM
  interface, an index to an entry in the generic configuration table

(pwTDMCfgTable), an index to an entry in the specific configuration
table (pwCXXXCfgTable, where XXX can be TDMoIP (TDM over IP) or
CESoPSN (Circuit Emulation Service over PSN)), config error
indications, and various status indications. The two indices of
the two configuration tables are providing the connection
parameters. The TDM interface can be a full link of any TDM type
like E1 or DS3, for example, or the interface of the bundle holding
the collection of time slots to be transmitted. Based on the TDM
PW type, the relevant pwXXXCfgTable from the relevant MIB module
will be used. The specific types are:

   o 17 Structure-agnostic E1 over Packet

   o 18 Structure-agnostic T1 (DS1) over Packet

   o 19 Structure-agnostic E3 over Packet

   o 20 Structure-agnostic T3 (DS3) over Packet

   o 21 CESoPSN basic mode (XXX=CESoPSN)

   o 22 TDMoIP AAL1mode (XXX=TDMoIP)

   o 23 CESoPSN TDM with CAS (XXX=CESoPSN)

   o 24 TDMoIP AAL2 Mode (XXX=TDMoIP)

  - The TDM Generic Parameter Table (pwTDMCfgTable) contains TDM
    generic configurable parameters for any TDM type.

  - The TDM Performance Current Table (pwTDMPerfCurrentTable) contains
    TDM statistics for the current 15-minute period.

  - The TDM Performance Interval Table (pwTDMPerfIntervalTable)
    contains TDM statistics for historical intervals (usually 96 15-
    minute entries to cover a 24 hour period).

  - The TDM Performance One-Day Interval Table
    (pwTDMPerf1DayIntervalTable) contains TDM statistics for historical
    intervals accumulated per day. Usually 30 one-day entries to cover
    a monthly period.

6.2. TDM Connection Configuration Procedure

   Configuring a TDM PW involves the following steps:

   First, configure the parameters of the interface-specific layer using
   the DS1-MIB and or the DS3-MIB.

   Next, if applicable, create a bundle of time slots using the DS0
   Bundle MIB [DS0MIB].

   Next, create an entry in the pwTable and configure the PSN tunnels:

   - Follow steps as defined in [PWMIB].

   NOTE: The agent should create an entry in the pwTDMTable for any
   entry created in the pwTable with pwType equal to a value between
   (17) and (24).

   Next complete the TDM PW configuration:

   - If necessary, create an entry in the relevant pwXXXCfgTable and in
     the pwTDMTable (suitable entries may already exist in both tables).

   - Set the index of the relevant pwXXXCfgTable entry and of the
     relevant pwTDMCfgTable entry in the pwTDMTable.

6.3. TDM PW Monitoring

   Upon making the TDM PW operational, the pwTDMPerfCurrentTable,
   pwTDMPerfIntervalTable, and PwTDMPerf1DayIntervalTable can be used to
   monitor the various counters, indicators, and conditions of the PW.
   All performance parameters are accumulated in daily intervals and in
   15-minute intervals. The number of daily intervals kept by the agent
   is based on the specific implementation. The 15-minute intervals, up
   to 96 intervals (24 hours worth), are all kept by the agent. Fewer
   than 96 intervals of data will be available if the agent has been
   restarted within the last 24 hours. Performance parameters continue
   to be collected when the interface is down. There is no requirement
   for an agent to ensure a fixed relationship between the start of a
   15-minute interval and any wall clock; however, some agents may align
   the 15-minute intervals with quarter hours. Performance parameters
   are of types PerfCurrentCount and PerfIntervalCount. These textual
   conventions are all Gauge32, and they are used because it is possible
   for these objects to decrease.

7. Example of Actual TDM PW Setup

   This section provides an example of using the various MIB objects
   described in the following section to set up a TDM PW connection.

   The first example is setting a connection of DS1 type. The second
   example is setting a connection with a bandwidth of 3 DS0 (time
   slots).

While those examples are not meant to illustrate all options of the
MIB, they are intended as an aid to understanding some of the key
concepts. See [PWMIB] for an example of setting up PSN tunnels.

First example:

1. Configure the DS1 interface using DS1-MIB.

2. If needed, create an entry in the pwTDMCfgTable (assuming index =
    10); verify that there are no errors in the configuration using
    the relevant object.

3. Get a new pwIndexNext [PWMIB] and create a new pwTable entry
    using the value of pwIndexNext (assume here, the PW index = 20).

4. Set the pwType [PWMIB] of the new entry to the relevant value
    (17) or (18). This should create a new entry in the pwTDMTable.

5. Configure the newly created TDM PW with the required pointers,
    indices, and the relevant entry in pwTDMCfgTable (index 10).

In [DS1MIB] dsx1IfIndex (ifIndex = 5)

   In pwTDMCfgTable entry: Set the connection characteristic
   parameters:

   {

   pwTDMCfgPayloadSize   = 43 -- payload bytes
   pwTDMCfgPktReorder   = FALSE
   pwTDMCfgRtpHdrUsed   = FALSE
   pwTDMCfgJtrBfrDepth   = 30000 -- micro-seconds

   }

   In pwTDMTable entry: Set the relevant ifIndex, the generic TDM
   index, and the specific TDM index to complete creation:

   {
     pwTDMIfIndex   = 5   -- IfIndex of associated entry
                                  -- in DS1 table
     pwGenTDMCfgIndex   = 10   -- Index of associated entry
                                  -- in pwTDMCfgTable.
     pwRelTDMCfgIndex   = 0   -- No Index in associated entry
                                  -- in pwXXXCfgTable.
   }

   Verify that there are no error bits set in pwTDMConfigError.

Second example:

1. Configure the DS1 interface using DS1-MIB.

2. Set up a bundle and get its dsx0BundleIfIndex. Setting up the
    bundle should involve using IFMIB properly.

3. Since structured TDMoIP circuit is defined, the next MIB module
    to be used is TDMoIP-MIB.

4. If needed, create an entry in the pwTDMCfgTable (assuming index =
    7).

5. If needed, create an entry in the pwXXXCfgTable (index = 11).
    XXX can be TDMoIP or CESoPSN.

6. Verify that there are no errors in the configuration using the
    relevant object when signaling is in use.

7. Get a new pwIndexNext [PWMIB] and create a new pwTable entry
    using the value of pwIndexNext.

8. Set the pwType [PWMIB] of the new entry to (24). This should
    create a new entry in the pwTDMTable.

9. Configure the newly created TDM PW with the required pointers,
    indices, and the relevant entries in pwTDMCfgTable and in
    pwXXXCfgTable (assuming indices 7 and 11).

    In [DS1MIB] dsx1IfIndex (ifIndex) = 5
    In [DS0MIB] dsx0BundleIfIndex   = 8

    In pwTDMTable entry: Set the relevant ifIndex, the generic
    TDM index, and the specific TDM index to complete creation:

    {
      pwTDMIfIndex   = 8   -- IfIndex of associated entry
                                     -- in DS0 table
      pwGenTDMCfgIndex   = 7   -- Index of associated entry
                                     -- in pwTDMCfgTable.
      pwRelTDMCfgIndex   = 11   -- Index of associated entry
                                     -- in pwXXXCfgTable.
      -- pwXXXCfgTable might be an implementation specific table too.
    }

Verify that there are no error bits set in pwTDMConfigError.

8.   Object Definition

     PW-TDM-MIB DEFINITIONS ::= BEGIN

     IMPORTS
       MODULE-IDENTITY, OBJECT-TYPE,
       Integer32, Counter32, Unsigned32, mib-2
          FROM SNMPv2-SMI

       MODULE-COMPLIANCE, OBJECT-GROUP
          FROM SNMPv2-CONF

       TEXTUAL-CONVENTION, TruthValue, RowStatus, StorageType,
        TimeStamp
          FROM SNMPv2-TC

       InterfaceIndexOrZero
          FROM IF-MIB   -- [IFMIB]

       SnmpAdminString
          FROM SNMP-FRAMEWORK-MIB   -- [RFC3411]

       PerfCurrentCount, PerfIntervalCount
          FROM PerfHist-TC-MIB

       pwIndex
          FROM PW-STD-MIB

       PwCfgIndexOrzero
          FROM PW-TC-STD-MIB;

     -- The TDM MIB

       pwTDMMIB MODULE-IDENTITY

       LAST-UPDATED "200906150000Z"
       ORGANIZATION "Pseudo-Wire Emulation Edge-to-Edge (PWE3)
                     Working Group"
       CONTACT-INFO
            "   Orly Nicklass
            Postal: RADVISION Ltd.
                    24Raul Wallenberg St.
                    Tel Aviv, Israel
                    Email: orlyn@radvision.com

            The PWE3 Working Group (email distribution pwe3@ietf.org,
            http://www.ietf.org/html.charters/pwe3-charter.html)
            "

       DESCRIPTION
            "This MIB contains managed object definitions for
             encapsulating TDM (T1,E1, T3, E3, NxDS0) as
             pseudo-wires over packet-switching networks (PSN).

             This MIB supplements the PW-STD-MIB as in: Zelig, D.,
             Nadeau, T. 'Pseudowire (PW) Management Information Base'.
             The PW-STD-MIB contains structures and MIB associations
             generic to pseudowire (PW) emulation. PW-specific
             MIBs (such as this) contain config and stats for specific
             PW types.

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             SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

             This version of this MIB module is part of RFC 5604;

```
            see the RFC itself for full legal notices.
            "

       REVISION   "200906150000Z"
       DESCRIPTION
           "Initial version published as part of RFC 5604."
       ::= { mib-2 186 }

   -- Local Textual conventions

      PwTDMCfgIndex ::= TEXTUAL-CONVENTION
        STATUS       current
        DESCRIPTION
            "Index into the relevant pwXXXCfgTable."
        SYNTAX Unsigned32 (1..4294967295)

   -- Notifications
   pwTDMNotifications OBJECT IDENTIFIER
                                 ::= { pwTDMMIB 0 }
   -- Tables, Scalars
   pwTDMObjects       OBJECT IDENTIFIER
                                 ::= { pwTDMMIB 1 }
   -- Conformance
   pwTDMConformance   OBJECT IDENTIFIER
                                 ::= { pwTDMMIB 2 }


   -- TDM PW table

   pwTDMTable OBJECT-TYPE
     SYNTAX         SEQUENCE OF PwTDMEntry
     MAX-ACCESS     not-accessible
     STATUS         current
     DESCRIPTION
         "This table contains basic information including the
          ifIndex and pointers to entries in the relevant TDM
          config tables for this TDM PW."
     ::= { pwTDMObjects 1 }

   pwTDMEntry OBJECT-TYPE
     SYNTAX         PwTDMEntry
     MAX-ACCESS     not-accessible
     STATUS         current
     DESCRIPTION
         "This table is indexed by the same index that was
          created for the associated entry in the PW Table
          (in the PW-STD-MIB).

             - The PwIndex.
```

         An entry is created in this table by the agent for every
         entry in the pwTable with a pwType equal to one of the
         following:
         e1Satop(17), t1Satop(18), e3Satop(19), t3Satop(20),
         basicCesPsn(21), basicTdmIp(22), tdmCasCesPsn(23),
         or tdmCasTdmIp(24).
         Unless otherwise specified, all writeable objects in this
         table MUST NOT be changed after row activation in the
         generic pwTable (see [PWMIB]) and values must persist
         after reboot."

    INDEX { pwIndex }

       ::= { pwTDMTable 1 }

   PwTDMEntry ::= SEQUENCE {

        pwTDMRate   Integer32,
        pwTDMIfIndex   InterfaceIndexOrZero,
        pwGenTDMCfgIndex   PwCfgIndexOrzero,
        pwRelTDMCfgIndex   PwCfgIndexOrzero,

        pwTDMConfigError   BITS,
        pwTDMTimeElapsed   Integer32,
        pwTDMValidIntervals   Integer32,
        pwTDMValidDayIntervals   Integer32,
        pwTDMLastEsTimeStamp   TimeStamp
        }

   pwTDMRate OBJECT-TYPE
     SYNTAX   Integer32
     MAX-ACCESS   read-write
     STATUS   current
     DESCRIPTION
        "The parameter represents the bit-rate of the TDM service
         in multiples of the 'basic' 64 Kbit/s rate [TDMCP-EXT].
         It complements the definition of pwType used in
         PW-STD-MIB.
         For structure-agnostic mode, the following should be used:
         a) (Structure-Agnostic TDM over Packet) Satop E1 - 32
         b) Satop T1 emulation:
            i)   MUST be set to 24 in the basic emulation mode
            ii) MUST be set to 25 for the 'Octet-aligned T1'
                 emulation mode
         c) Satop E3 - 535
         d) Satop T3 - 699
         For all kinds of structure-aware emulation, this parameter
         MUST be set to N where N is the number of DS0 channels

```
            in the corresponding attachment circuit."
     REFERENCE
      "TDMCP-EXT"
     DEFVAL { 32 }
     ::= { pwTDMEntry 1 }

  pwTDMIfIndex OBJECT-TYPE
     SYNTAX         InterfaceIndexOrZero
     MAX-ACCESS     read-write
     STATUS         current
     DESCRIPTION
         "This is a unique index within the ifTable.  It represents
          the interface index of the full link or the interface
          index for the bundle holding the group of
          time slots to be transmitted via this PW connection.

          A value of zero indicates an interface index that has yet
          to be determined.
          Once set, if the TDM ifIndex is (for some reason) later
          removed, the agent SHOULD delete the associated PW rows
          (e.g., this pwTDMTable entry).  If the agent does not
          delete the rows, the agent MUST set this object to
          zero."
     ::= { pwTDMEntry 2 }

  pwGenTDMCfgIndex OBJECT-TYPE
     SYNTAX         PwCfgIndexOrzero
     MAX-ACCESS     read-write
     STATUS         current
     DESCRIPTION
         "Index to the generic parameters in the TDM configuration
          table that appears in this MIB module.  It is likely that
          multiple TDM PWs of the same characteristic will share
          a single TDM Cfg entry."
     ::= { pwTDMEntry 3 }

  pwRelTDMCfgIndex OBJECT-TYPE
     SYNTAX         PwCfgIndexOrzero
     MAX-ACCESS     read-write
     STATUS         current
     DESCRIPTION
         "Index to the relevant TDM configuration table entry
          that appears in one of the related MIB modules
          such as TDMoIP or CESoPSN.  It is likely that
          multiple TDM PWs of the same characteristic will share
          a single configuration entry of the relevant type.
          The value 0 implies no entry in other related MIBs."
     ::= { pwTDMEntry 4 }
```

```
   pwTDMConfigError OBJECT-TYPE
     SYNTAX BITS {
          notApplicable              ( 0),
          tdmTypeIncompatible        ( 1),
          peerRtpIncompatible        ( 2),
          peerPayloadSizeIncompatible  ( 3)
          }
     MAX-ACCESS    read-only
     STATUS        current
     DESCRIPTION
         "Any of the bits are set if the local configuration is
          not compatible with the peer configuration as available
          from the various parameters options.  Setting is done based
          on signaling, or else value (0) will be set.

          -tdmTypeIncompatible bit is set if the local configuration
          is not carrying the same TDM type as the peer configuration.

          -peerRtpIncompatible bit is set if the local configuration
          is configured to send RTP packets for this PW, and the
          remote is not capable of accepting RTP packets.

          -peerPayloadSizeIncompatible bit is set if the local
          configuration is not carrying the same Payload Size as the
          peer configuration."
     ::= { pwTDMEntry 5}

   pwTDMTimeElapsed OBJECT-TYPE
      SYNTAX  Integer32 (1..900)
      MAX-ACCESS  read-only
      STATUS  current
      DESCRIPTION
          "The number of seconds, including partial seconds,
           that have elapsed since the beginning of the current
           measurement period.  If, for some reason, such as an
           adjustment in the system's time-of-day clock, the
           current interval exceeds the maximum value, the
           agent will return the maximum value."
      ::= { pwTDMEntry 6}

   pwTDMValidIntervals OBJECT-TYPE
      SYNTAX  Integer32 (0..96)
      MAX-ACCESS  read-only
      STATUS  current
```

```
      DESCRIPTION
          "The number of previous 15-minute intervals for which data
           was collected.
           An agent with TDM capability must be capable of supporting
           at least n intervals.  The minimum value of n is 4.  The
           default of n is 32 and the maximum value of n is 96.
           The value will be n unless the measurement was (re-)
           started within the last (n*15) minutes, in which case,
           the value will be the number of complete 15-minute
           intervals for which the agent has at least some data.
           In certain cases (e.g., 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 data is available."
      ::= { pwTDMEntry 7}

   pwTDMValidDayIntervals OBJECT-TYPE
      SYNTAX  Integer32 (0..30)
      MAX-ACCESS  read-only
      STATUS  current
      DESCRIPTION
          "The number of previous days for which data
           was collected.
           An agent with TDM capability must be capable of supporting
           at least n intervals.  The minimum value of n is 1.  The
           default of n is 1 and the maximum value of n is 30."
      ::= { pwTDMEntry 8}

   pwTDMLastEsTimeStamp OBJECT-TYPE
     SYNTAX        TimeStamp
     MAX-ACCESS  read-only
     STATUS        current
     DESCRIPTION
         "The value of sysUpTime at the most recent occasion at
          which the TDM PW entered the ES or SES state."
     ::= { pwTDMEntry 11}

   -- End of TDM PW table

   -- PW Generic TDM PW Configuration Table

   pwTDMCfgIndexNext OBJECT-TYPE
     SYNTAX            Unsigned32
     MAX-ACCESS        read-only
     STATUS            current
```

```
   DESCRIPTION
       "This object contains the value to be used for
        pwTDMCfgIndex when creating entries in the
        pwTDMCfgTable.  The value 0 indicates that no
        unassigned entries are available.  To obtain the
        value of pwTDMCfgIndexNext for a new entry in the
        pwTDMCfgTable, the manager issues a management
        protocol retrieval operation.  The agent will
        determine through its local policy when this
        index value will be made available for reuse."
   ::= { pwTDMObjects 2 }

 pwTDMCfgTable   OBJECT-TYPE
   SYNTAX                  SEQUENCE OF PwTDMCfgEntry
   MAX-ACCESS              not-accessible
   STATUS                  current
   DESCRIPTION
       "This table contains a set of parameters that may be
        referenced by one or more TDM PWs in pwTDMTable."
   ::= { pwTDMObjects 3 }

 pwTDMCfgEntry   OBJECT-TYPE
     SYNTAX             PwTDMCfgEntry
     MAX-ACCESS         not-accessible
     STATUS             current
     DESCRIPTION
         "These parameters define the characteristics of a
          TDM PW.  They are grouped here to ease NMS burden.
          Once an entry is created here it may be re-used
          by many PWs.
          Unless otherwise specified, all objects in this table
          MUST NOT be changed after row activation (see [PWMIB])."

    INDEX  { pwTDMCfgIndex }

      ::= { pwTDMCfgTable 1 }

 PwTDMCfgEntry ::= SEQUENCE {
     pwTDMCfgIndex                  PwTDMCfgIndex,
     pwTDMCfgRowStatus              RowStatus,
     pwTDMCfgPayloadSize            Unsigned32,
     pwTDMCfgPktReorder             TruthValue,
     pwTDMCfgRtpHdrUsed             TruthValue,
     pwTDMCfgJtrBfrDepth            Unsigned32,
     pwTDMCfgPayloadSuppression     INTEGER,

     pwTDMCfgConsecPktsInSynch      Unsigned32,
     pwTDMCfgConsecMissPktsOutSynch Unsigned32,
```

```
      pwTDMCfgSetUp2SynchTimeOut       Unsigned32,

      pwTDMCfgPktReplacePolicy         INTEGER,

      pwTDMCfgAvePktLossTimeWindow     Integer32,
      pwTDMCfgExcessivePktLossThreshold   Unsigned32,

      pwTDMCfgAlarmThreshold           Unsigned32,
      pwTDMCfgClearAlarmThreshold      Unsigned32,
      pwTDMCfgMissingPktsToSes         Unsigned32,

      pwTDMCfgTimestampMode            INTEGER,
      pwTDMCfgStorageType              StorageType,
      pwTDMCfgPktFiller                Unsigned32,
      pwTDMCfgName                     SnmpAdminString
      }

  pwTDMCfgIndex   OBJECT-TYPE
    SYNTAX        PwTDMCfgIndex
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "Index to an entry in this table.  When an NMS creates
         a new entry/row in this table, it best makes use of
         the value of the pwTDMCfgIndexNext object in order to
         find a free or available index value."
    ::= { pwTDMCfgEntry 1 }

  pwTDMCfgRowStatus    OBJECT-TYPE
    SYNTAX            RowStatus
    MAX-ACCESS        read-create
    STATUS            current
    DESCRIPTION
        "Object used for creating, modifying, and deleting
         a row from this table.  The following objects cannot be
         modified if the entry is in use and the status is active:
         pwTDMCfgPayloadSize, pwTDMCfgRtpHdrUsed,
         pwTDMCfgJtrBfrDepth, and pwTDMCfgPayloadSuppression.
         The row cannot be deleted if the entry is in use."
    ::= { pwTDMCfgEntry 2 }

  pwTDMCfgPayloadSize OBJECT-TYPE
    SYNTAX        Unsigned32
    MAX-ACCESS    read-create
    STATUS        current
```

          DESCRIPTION
              "The value of this object indicates the PayLoad Size (in bytes)
               to be defined during the PW setUp. Upon TX, implementation
               must be capable of carrying that amount of bytes.
               Upon RX, when the Low Entry Networking (LEN) field is set
               to 0, the payload of packet MUST assume this size, and if
               the actual packet size is inconsistent with this length,
               the packet MUST be considered to be malformed."
          ::= { pwTDMCfgEntry 4 }

      pwTDMCfgPktReorder OBJECT-TYPE
         SYNTAX   TruthValue
         MAX-ACCESS   read-create
         STATUS   current
         DESCRIPTION
              "If set to True: as CE-bound packets are queued in the
               jitter buffer, out of order packets are re-ordered. The
               maximum sequence number differential (i.e., the range in
               which re-sequencing can occur) is dependant on the depth
               of the jitter buffer. See pwTDMCfgJtrBfrDepth.

               NOTE: Some implementations may not support this feature.
               The agent should then reject a SET request for true."
          ::= { pwTDMCfgEntry 5 }

      pwTDMCfgRtpHdrUsed OBJECT-TYPE
         SYNTAX   TruthValue
         MAX-ACCESS   read-create
         STATUS   current
         DESCRIPTION
              "If set to False: an RTP header is not pre-pended to the
               TDM packet."
         REFERENCE
           "SATOP"
         DEFVAL { false }
          ::= { pwTDMCfgEntry 6 }

      pwTDMCfgJtrBfrDepth OBJECT-TYPE
         SYNTAX   Unsigned32
         UNITS   "microsecond"
         MAX-ACCESS   read-create
         STATUS   current
         DESCRIPTION
              "The size of this buffer SHOULD be locally
               configured to allow accommodation to the PSN-specific packet
               delay variation.

```
        If configured to a value not supported by the
        implementation, the agent MUST return an error code
        'jtrBfrDepth' in 'pwTDMConfigError'.

        NOTE: jitter buffers are a limited resource to
        be managed.  The actual size should be at least twice as big
        as the value of pwTDMCfgJtrBfrDepth."
  DEFVAL { 3000 }
  ::= { pwTDMCfgEntry 7 }

pwTDMCfgPayloadSuppression  OBJECT-TYPE
  SYNTAX          INTEGER
                   {
                      enable  ( 1),
                      disable ( 2)
                   }
  MAX-ACCESS   read-create
  STATUS       current
  DESCRIPTION
      "Selecting 'enable' means: Payload suppression is allowed.
       Payload MAY be omitted in order to conserve bandwidth.
       Selecting 'disable' means: No suppression under any
       condition.
       Object MAY be changed at any time."
 DEFVAL { disable }
  ::= { pwTDMCfgEntry 8 }

pwTDMCfgConsecPktsInSynch          OBJECT-TYPE
  SYNTAX       Unsigned32 (1..10)
  MAX-ACCESS   read-create
  STATUS       current
  DESCRIPTION
      "The number of consecutive packets with sequential
       sequence numbers that are required to exit the
       LOPS.
       Object MAY be changed only when the related PW is
       defined as not active."
  REFERENCE
      "SATOP"
  DEFVAL { 2 }
  ::= { pwTDMCfgEntry 9 }

pwTDMCfgConsecMissPktsOutSynch  OBJECT-TYPE
  SYNTAX       Unsigned32 (1..15)
  MAX-ACCESS   read-create
  STATUS       current
  DESCRIPTION
      "The number of consecutive missing packets that are
```

```
       required to enter the LOPS.
       Object MAY be changed only when the related PW is
       defined as not active."
   REFERENCE
       "SATOP"
   DEFVAL { 10 }
   ::= { pwTDMCfgEntry 10 }

pwTDMCfgSetUp2SynchTimeOut OBJECT-TYPE
   SYNTAX        Unsigned32
   UNITS         "millisecond"
   MAX-ACCESS    read-create
   STATUS        current
   DESCRIPTION
       "The amount of time the host should wait before declaring the
       pseudowire in a down state, if the number of consecutive
       TDM packets that have been received after changing the
       administrative status to up and after finalization of
       signaling (if supported) between the two PEs is smaller
       than pwTDMCfgConsecPktsInSynch.  Once the PW has
       OperStatus of 'up', this parameter is no longer valid.  This
       parameter is defined to ensure that the host does not
       prematurely inform failure of the PW.  In particular, PW
       'down' notifications should not be sent before expiration
       of this timer.  This parameter is valid only after
       administrative changes of the status of the PW.  If the PW
       fails due to network impairments, a 'down' notification
       should be sent.
       Object MAY be changed only when the related PW is
       defined as not active."
   DEFVAL {5000}
   ::= { pwTDMCfgEntry 11 }

pwTDMCfgPktReplacePolicy OBJECT-TYPE
   SYNTAX        INTEGER
                       {
                        allOnes (1),
                        implementationSpecific(2),
                        filler (3)  --user defined
                       }
   MAX-ACCESS    read-create
   STATUS        current
   DESCRIPTION
       "This parameter determines the value to be played when CE bound
       packets over/underflow the jitter buffer, or are missing
       for any reason.  This byte pattern is sent (played) on
       the TDM line.  Selecting implementationSpecific(2) implies an
       agent-specific algorithm.  Selecting filler(3) requires
```

```
        the setting of pwTDMCfgPktFiller.
        Object MAY be changed only when the related PW is
        defined as not active."
   DEFVAL { allOnes } -- Play AIS
   ::= { pwTDMCfgEntry 12 }

pwTDMCfgAvePktLossTimeWindow OBJECT-TYPE
   SYNTAX          Integer32
   UNITS           "millisecond"
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "The length of time over which the average packet
        loss rate should be computed to detect excessive packet
        loss rate.
        Object MAY be changed only when the related PW is
        defined as not active."
   ::= { pwTDMCfgEntry 13}

pwTDMCfgExcessivePktLossThreshold OBJECT-TYPE
   SYNTAX          Unsigned32
   UNITS           "Percent"
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "Excessive packet loss rate is detected by computing the
        average packet-loss rate over a pwTDMCfgAvePktLossTimeWindow
        amount of time and comparing it with this threshold value.
        The rate is expressed in percentage.
        Object MAY be changed only when the related PW is
        defined as not active."
   ::= { pwTDMCfgEntry 14 }

pwTDMCfgAlarmThreshold OBJECT-TYPE
   SYNTAX          Unsigned32
   UNITS           "milisec"
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "Alarms are only reported when the defect state persists
        for the length of time specified by this object.
        Object MAY be changed only when the related PW is
        defined as not active."
   DEFVAL { 2500 }
   ::= { pwTDMCfgEntry 15 }

pwTDMCfgClearAlarmThreshold OBJECT-TYPE
   SYNTAX          Unsigned32
```

```
     UNITS          "milisec"
     MAX-ACCESS     read-create
     STATUS         current
     DESCRIPTION
         "Alarm MUST be cleared after the corresponding defect is
          undetected for the amount of time specified by this object.
          Object MAY be changed only when the related PW is
          defined as not active."
     DEFVAL { 10000 }
     ::= { pwTDMCfgEntry 16 }

  pwTDMCfgMissingPktsToSes OBJECT-TYPE
     SYNTAX         Unsigned32
     UNITS          "Percent"
     MAX-ACCESS     read-create
     STATUS         current
     DESCRIPTION
         "Percent of missing packets detected (consecutive or not)
          within a 1-second window to cause a Severely Error
          Second (SES) to be counted.
          Object MAY be changed only when the related PW is
          defined as not active."
     DEFVAL { 30 }
     ::= { pwTDMCfgEntry 17 }

  pwTDMCfgTimestampMode  OBJECT-TYPE
     SYNTAX         INTEGER
                     {
                      notApplicable (1),
                      absolute      (2),
                      differential  (3)
                     }

     MAX-ACCESS     read-create
     STATUS         current
     DESCRIPTION
         "Timestamp generation MAY be used in one of the following
          modes:
          1. Absolute mode: The PSN-bound IWF sets timestamps
           using the clock recovered from the incoming TDM attachment
           circuit.  As a consequence, the timestamps are closely
           correlated with the sequence numbers.  All TDM
           implementations that support usage of the RTP header MUST
           support this mode.
          2. Differential mode: Both IWFs have access to a common high-
           quality timing source, and this source is used for timestamp
           generation.  Support of this mode is OPTIONAL.
           Object MAY be changed only when the related PW is
```

```
         defined as not active."
   ::= { pwTDMCfgEntry 18 }

  pwTDMCfgStorageType  OBJECT-TYPE
    SYNTAX            StorageType
    MAX-ACCESS        read-create
    STATUS            current
    DESCRIPTION
        "This variable indicates the storage type for this
         row.  Conceptual rows having the value permanent(4) must
         allow write-access to all columnar objects."
   ::= { pwTDMCfgEntry 19 }

  pwTDMCfgPktFiller OBJECT-TYPE
     SYNTAX         Unsigned32 (0..255)
     MAX-ACCESS     read-create
     STATUS         current
     DESCRIPTION
         "Filler byte pattern played out on the TDM
          interface if pwTDMCfgPktReplacePolicy
          was set to filler(3).
          Object MAY be changed only when the related PW is
          defined as not active."
     DEFVAL
         { 255 } -- Play all ones, equal to AIS indications.
      ::= { pwTDMCfgEntry 20 }

  pwTDMCfgName OBJECT-TYPE
    SYNTAX         SnmpAdminString
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
        "A descriptive string, preferably a unique name, to an entry
         in this table.
         Object MAY be changed at any time."
     ::= { pwTDMCfgEntry 21 }

  -- End of Table

  -- The following counters work together to integrate
  -- errors and the lack of errors on the TDM PW.  An error is
  -- caused by a missing packet.  A missing packet can be a result
  -- of: packet loss in the network, (uncorrectable) packet out
  -- of sequence, packet length error, jitter buffer overflow,
  -- and jitter buffer underflow.  The result is declaring whether
  -- or not the TDM PW is in Loss of Packet State (LOPS).

  -- TDM PW Performance Current Table
```

```
pwTDMPerfCurrentTable OBJECT-TYPE
   SYNTAX        SEQUENCE OF PwTDMPerfCurrentEntry
   MAX-ACCESS    not-accessible
   STATUS        current
   DESCRIPTION
       "The current 15-minute interval counts are in
        this table.

        This table provides per TDM PW performance information."

   ::= { pwTDMObjects 5 }

pwTDMPerfCurrentEntry OBJECT-TYPE
   SYNTAX        PwTDMPerfCurrentEntry
   MAX-ACCESS    not-accessible
   STATUS        current
   DESCRIPTION
       "An entry in this table is created by the agent for every
        pwTDMTable entry.  After 15 minutes, the contents of this
        table entry are copied to a new entry in the
        pwTDMPerfInterval table, and the counts in this entry
        are reset to zero."

   INDEX  { pwIndex }

   ::= { pwTDMPerfCurrentTable 1 }

PwTDMPerfCurrentEntry ::= SEQUENCE {

    pwTDMPerfCurrentMissingPkts        PerfCurrentCount,
    pwTDMPerfCurrentPktsReOrder        PerfCurrentCount,
    pwTDMPerfCurrentJtrBfrUnderruns    PerfCurrentCount,
    pwTDMPerfCurrentMisOrderDropped    PerfCurrentCount,
    pwTDMPerfCurrentMalformedPkt       PerfCurrentCount,

    pwTDMPerfCurrentESs                PerfCurrentCount,
    pwTDMPerfCurrentSESs               PerfCurrentCount,
    pwTDMPerfCurrentUASs               PerfCurrentCount,
    pwTDMPerfCurrentFC                 PerfCurrentCount
   }

pwTDMPerfCurrentMissingPkts OBJECT-TYPE
   SYNTAX        PerfCurrentCount
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "Number of missing packets (as detected via control word
        sequence number gaps)."
```

```
    ::= { pwTDMPerfCurrentEntry 1 }

pwTDMPerfCurrentPktsReOrder OBJECT-TYPE
  SYNTAX          PerfCurrentCount
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "Number of packets detected out of sequence (via control
       word sequence number) but successfully re-ordered.
       Note: some implementations may not support this feature."
  ::= { pwTDMPerfCurrentEntry 2 }

pwTDMPerfCurrentJtrBfrUnderruns OBJECT-TYPE
  SYNTAX          PerfCurrentCount
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "Number of times a packet needed to be played
       out and the jitter buffer was empty."
  ::= { pwTDMPerfCurrentEntry 3 }

pwTDMPerfCurrentMisOrderDropped OBJECT-TYPE
  SYNTAX          PerfCurrentCount
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "Number of packets detected out of order (via control word
       sequence numbers) that could not be re-ordered or could
       not fit in the jitter buffer."
   ::= { pwTDMPerfCurrentEntry 4 }

pwTDMPerfCurrentMalformedPkt OBJECT-TYPE
  SYNTAX          PerfCurrentCount
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "Number of packets detected with unexpected size or
       bad headers' stack."
  ::= { pwTDMPerfCurrentEntry 5 }

pwTDMPerfCurrentESs OBJECT-TYPE
   SYNTAX          PerfCurrentCount
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "The counter associated with the number of Error
        Seconds encountered.  Any malformed packet, sequence error,
        LOPS, and the like are considered as Error Seconds."
```

```
        ::= { pwTDMPerfCurrentEntry 6 }

   pwTDMPerfCurrentSESs OBJECT-TYPE
       SYNTAX         PerfCurrentCount
       MAX-ACCESS     read-only
       STATUS         current
       DESCRIPTION
           "The counter associated with the number of
            Severely Error Seconds encountered."
       ::= { pwTDMPerfCurrentEntry 7 }

   pwTDMPerfCurrentUASs OBJECT-TYPE
       SYNTAX         PerfCurrentCount
       MAX-ACCESS     read-only
       STATUS         current
       DESCRIPTION
           "The counter associated with the number of
            Unavailable Seconds encountered.  Any consecutive
            ten seconds of SES are counted as one Unavailable
            Seconds (UAS)."
       ::= { pwTDMPerfCurrentEntry 8 }

   pwTDMPerfCurrentFC OBJECT-TYPE
       SYNTAX         PerfCurrentCount
       MAX-ACCESS     read-only
       STATUS         current
       DESCRIPTION
           "TDM Failure Counts (FC-TDM).  The number of TDM failure
            events.  A failure event begins when the LOPS failure
            is declared, and it ends when the failure is cleared.  A
            failure event that begins in one period and ends in
            another period is counted only in the period in which
            it begins."
       ::= { pwTDMPerfCurrentEntry 9 }

   -- End TDM PW Performance Current Interval Table

   -- TDM PW Performance Interval Table

   pwTDMPerfIntervalTable OBJECT-TYPE
      SYNTAX         SEQUENCE OF PwTDMPerfIntervalEntry
      MAX-ACCESS     not-accessible
      STATUS         current
```

```
   DESCRIPTION
       "This table provides performance information per TDM PW
        similar to the pwTDMPerfCurrentTable above.  However,
        these counts represent historical 15-minute intervals.
        Typically, this table will have a maximum of 96 entries
        for a 24 hour period, but is not limited to this."
   ::= { pwTDMObjects 6 }

 pwTDMPerfIntervalEntry OBJECT-TYPE
   SYNTAX         PwTDMPerfIntervalEntry
   MAX-ACCESS     not-accessible
   STATUS         current
   DESCRIPTION
       "An entry in this table is created by the agent for
        every pwTDMPerfCurrentEntry that is 15 minutes old.
        The contents of the Current entry are copied to the new
        entry here.  The Current entry then resets its counts
        to zero for the next current 15-minute interval."

   INDEX  { pwIndex, pwTDMPerfIntervalNumber }

   ::= { pwTDMPerfIntervalTable 1 }

 PwTDMPerfIntervalEntry ::= SEQUENCE {
     pwTDMPerfIntervalNumber         Unsigned32,
     pwTDMPerfIntervalValidData      TruthValue,
     pwTDMPerfIntervalDuration       Unsigned32,

     pwTDMPerfIntervalMissingPkts    PerfIntervalCount,
     pwTDMPerfIntervalPktsReOrder    PerfIntervalCount,
     pwTDMPerfIntervalJtrBfrUnderruns PerfIntervalCount,
     pwTDMPerfIntervalMisOrderDropped PerfIntervalCount,
     pwTDMPerfIntervalMalformedPkt   PerfIntervalCount,

     pwTDMPerfIntervalESs            PerfIntervalCount,
     pwTDMPerfIntervalSESs           PerfIntervalCount,
     pwTDMPerfIntervalUASs           PerfIntervalCount,
     pwTDMPerfIntervalFC             PerfIntervalCount
     }

 pwTDMPerfIntervalNumber OBJECT-TYPE
   SYNTAX         Unsigned32 (1..96)
   MAX-ACCESS     not-accessible
   STATUS         current
   DESCRIPTION
       "A number (normally between 1 and 96 to cover a 24 hour
        period) that identifies the interval for which the set
        of statistics is available.  The interval identified by 1
```

```
         is the most recently completed 15-minute interval, and
         the interval identified by N is the interval immediately
         preceding the one identified by N-1.  The minimum range of
         N is 1 through 4.  The default range is 1 through 32.  The
         maximum value of N is 1 through 96."
    ::= { pwTDMPerfIntervalEntry 1 }

pwTDMPerfIntervalValidData OBJECT-TYPE
   SYNTAX        TruthValue
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "This variable indicates if the data for this interval
        is valid."
    ::= { pwTDMPerfIntervalEntry 2 }

pwTDMPerfIntervalDuration OBJECT-TYPE
    SYNTAX        Unsigned32
    UNITS         "seconds"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
      "The duration of a particular interval in seconds.
       Adjustments in the system's time-of-day clock may
       cause the interval to be greater or less than the
       normal value.  Therefore, this actual interval value
       is provided."
     ::= { pwTDMPerfIntervalEntry 3 }

pwTDMPerfIntervalMissingPkts OBJECT-TYPE
   SYNTAX        PerfIntervalCount
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "Number of missing packets (as detected via control
        word sequence number gaps)."
    ::= { pwTDMPerfIntervalEntry 4 }

pwTDMPerfIntervalPktsReOrder OBJECT-TYPE
   SYNTAX        PerfIntervalCount
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "Number of packets detected out of sequence (via control
        word sequence number) but successfully re-ordered.
        Note: some implementations may not support this
        feature."
    ::= { pwTDMPerfIntervalEntry 5 }
```

```
   pwTDMPerfIntervalJtrBfrUnderruns OBJECT-TYPE
      SYNTAX         PerfIntervalCount
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
          "Number of times a packet needed to be played
           out and the jitter buffer was empty."
      ::= { pwTDMPerfIntervalEntry 6 }

   pwTDMPerfIntervalMisOrderDropped OBJECT-TYPE
      SYNTAX         PerfIntervalCount
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
          "Number of packets detected out of order (via control word
           sequence numbers) that could not be re-ordered or could
           not fit in the jitter buffer."
      ::= { pwTDMPerfIntervalEntry 7 }

   pwTDMPerfIntervalMalformedPkt OBJECT-TYPE
      SYNTAX         PerfIntervalCount
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
          "Number of packets detected with unexpected size, or
           bad headers' stack"
      ::= { pwTDMPerfIntervalEntry 8 }


   pwTDMPerfIntervalESs OBJECT-TYPE
      SYNTAX         PerfIntervalCount
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
          "The counter associated with the number of Error
           Seconds encountered."
      ::= { pwTDMPerfIntervalEntry 9 }

   pwTDMPerfIntervalSESs OBJECT-TYPE
      SYNTAX         PerfIntervalCount
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
          "The counter associated with the number of
           Severely Error Seconds encountered."
      ::= { pwTDMPerfIntervalEntry 10 }
```

```
   pwTDMPerfIntervalUASs OBJECT-TYPE
     SYNTAX          PerfIntervalCount
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The counter associated with the number of
          Unavailable Seconds encountered."
     ::= { pwTDMPerfIntervalEntry 11 }

   pwTDMPerfIntervalFC OBJECT-TYPE
     SYNTAX          PerfIntervalCount
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "TDM Failure Counts (FC-TDM).  The number of TDM failure
          events.  A failure event begins when the LOPS failure
          is declared, and it ends when the failure is cleared.  A
          failure event that begins in one period and ends in
          another period is counted only in the period in which
          it begins."
     ::= { pwTDMPerfIntervalEntry 12 }

   -- End TDM PW Performance Interval Table

   -- TDM PW 1day Performance Table

   pwTDMPerf1DayIntervalTable OBJECT-TYPE
     SYNTAX          SEQUENCE OF PwTDMPerf1DayIntervalEntry
     MAX-ACCESS      not-accessible
     STATUS          current
     DESCRIPTION
         "This table provides performance information per TDM PW
          similar to the pwTDMPerfIntervalTable above.  However,
          these counters represent historical one-day intervals up to
          one full month.  The table consists of real-time data, as
          such it is not persistence across re-boot."
     ::= { pwTDMObjects 7 }

   pwTDMPerf1DayIntervalEntry OBJECT-TYPE
     SYNTAX          PwTDMPerf1DayIntervalEntry
     MAX-ACCESS      not-accessible
     STATUS          current
     DESCRIPTION
         "An entry is created in this table by the agent
          for every entry in the pwTDMTable table."

     INDEX  { pwIndex,pwTDMPerf1DayIntervalNumber }
```

```
        ::= { pwTDMPerf1DayIntervalTable 1 }

  PwTDMPerf1DayIntervalEntry ::= SEQUENCE {
       pwTDMPerf1DayIntervalNumber            Unsigned32,
       pwTDMPerf1DayIntervalValidData         TruthValue,
       pwTDMPerf1DayIntervalDuration          Unsigned32,
       pwTDMPerf1DayIntervalMissingPkts       Counter32,
       pwTDMPerf1DayIntervalPktsReOrder       Counter32,
       pwTDMPerf1DayIntervalJtrBfrUnderruns   Counter32,
       pwTDMPerf1DayIntervalMisOrderDropped   Counter32,
       pwTDMPerf1DayIntervalMalformedPkt      Counter32,

       pwTDMPerf1DayIntervalESs               Counter32,
       pwTDMPerf1DayIntervalSESs              Counter32,
       pwTDMPerf1DayIntervalUASs              Counter32,
       pwTDMPerf1DayIntervalFC                Counter32
       }

  pwTDMPerf1DayIntervalNumber OBJECT-TYPE
     SYNTAX        Unsigned32 (1..30)
     MAX-ACCESS    not-accessible
     STATUS        current
     DESCRIPTION
         "The number of intervals where 1 indicates the current day
          measured period and 2 and above indicate previous days,
          respectively."
     ::= { pwTDMPerf1DayIntervalEntry 1 }

  pwTDMPerf1DayIntervalValidData OBJECT-TYPE
     SYNTAX        TruthValue
     MAX-ACCESS    read-only
     STATUS        current
     DESCRIPTION
         "This variable indicates if the data for this interval
          is valid."
     ::= { pwTDMPerf1DayIntervalEntry 2 }

  pwTDMPerf1DayIntervalDuration OBJECT-TYPE
     SYNTAX        Unsigned32
     UNITS         "seconds"
     MAX-ACCESS    read-only
     STATUS        current
     DESCRIPTION
       "The duration of a particular interval in seconds.
        Adjustments in the system's time-of-day clock may
        cause the interval to be greater or less than the
        normal value.  Therefore, this actual interval value
        is provided."
```

         ::= { pwTDMPerf1DayIntervalEntry 3 }

      pwTDMPerf1DayIntervalMissingPkts OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
           "Number of missing packets (as detected via control word
            sequence number gaps)."
         ::= { pwTDMPerf1DayIntervalEntry 4 }

      pwTDMPerf1DayIntervalPktsReOrder OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
             "Number of packets detected out of sequence (via control
              word sequence number) but successfully re-ordered.
              Note: some implementations may not support this
              feature."
         ::= { pwTDMPerf1DayIntervalEntry 5 }

      pwTDMPerf1DayIntervalJtrBfrUnderruns OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
             "Number of times a packet needed to be played
              out and the jitter buffer was empty."
         ::= { pwTDMPerf1DayIntervalEntry 6 }

      pwTDMPerf1DayIntervalMisOrderDropped OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
             "Number of packets detected out of order (via control word
              sequence numbers) that could not be re-ordered or could
              not fit in the jitter buffer."
         ::= { pwTDMPerf1DayIntervalEntry 7 }

      pwTDMPerf1DayIntervalMalformedPkt OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
             "Number of packets detected with unexpected size or
              bad headers' stack."

```
   ::= { pwTDMPerf1DayIntervalEntry 8 }

pwTDMPerf1DayIntervalESs OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "The counter associated with the number of Error
        Seconds encountered."
   ::= { pwTDMPerf1DayIntervalEntry 9 }

pwTDMPerf1DayIntervalSESs OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "The counter associated with the number of Severely
        Error Seconds."
   ::= { pwTDMPerf1DayIntervalEntry 10 }

pwTDMPerf1DayIntervalUASs OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "The counter associated with the number of
        UnAvailable Seconds.

        NOTE: When first entering the UAS state, the number
        of SES to UAS is added to this object, then as each
        additional UAS occurs, this object increments by one."

   ::= { pwTDMPerf1DayIntervalEntry 11 }

pwTDMPerf1DayIntervalFC OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
       "TDM Failure Counts (FC-TDM).  The number of TDM failure
        events.  A failure event begins when the LOPS failure
        is declared, and it ends when the failure is cleared."
   ::= { pwTDMPerf1DayIntervalEntry 12 }

-- End of PW TDM Performance table

-- Conformance Information
```

     pwTDMCompliances OBJECT IDENTIFIER ::= { pwTDMConformance 1 }
     pwTDMGroups   OBJECT IDENTIFIER ::= { pwTDMConformance 2 }

     pwTDMModuleCompliance MODULE-COMPLIANCE
         STATUS current
         DESCRIPTION
             "The compliance statement for agent that support TDM PW
              over PSN operation."

         MODULE -- this module
             MANDATORY-GROUPS { pwTDMGroup,
                                pwTDMPerfCurrentGroup,
                                pwTDMPerfIntervalGroup,
                                pwTDMPerf1DayIntervalGroup
                              }

                       OBJECT pwGenTDMCfgIndex
                       MIN-ACCESS read-only
                       DESCRIPTION
                           "The ability to set an index pointer
                           is not required."

                       OBJECT pwRelTDMCfgIndex
                       MIN-ACCESS read-only
                       DESCRIPTION
                           "The ability to set an index pointer
                           is not required."

                       OBJECT pwTDMCfgPktReorder
                       MIN-ACCESS read-only
                       DESCRIPTION
                           "The ability to set the packet reordering
                           is not required. If the feature is not
                           supported, the value set by the agent MUST
                           be FALSE."

                       OBJECT pwTDMCfgRtpHdrUsed
                       MIN-ACCESS read-only
                       DESCRIPTION
                           "The ability to set whether or not to use the
                            RTP header is not required."

                       OBJECT pwTDMCfgPayloadSuppression
                       MIN-ACCESS read-only
                       DESCRIPTION
                           "The ability to set this object is not
                            required."

```
                        OBJECT pwTDMCfgPktReplacePolicy
                        MIN-ACCESS read-only
                        DESCRIPTION
                            "The ability to set the replace policy
                            is not required."

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

                        OBJECT pwTDMCfgPktFiller
                        MIN-ACCESS read-only
                        DESCRIPTION
                            "The ability to set the filler pattern
                            is not required."
                        OBJECT pwTDMCfgName
                        MIN-ACCESS read-only
                        DESCRIPTION
                            "The ability to set an alias
                            is not required."

        ::= { pwTDMCompliances 1 }

    -- Units of conformance

    pwTDMGroup OBJECT-GROUP
      OBJECTS {
                pwTDMRate,
                pwTDMIfIndex,
                pwGenTDMCfgIndex,
                pwRelTDMCfgIndex,
                pwTDMConfigError,
                pwTDMTimeElapsed,
                pwTDMValidIntervals,
                pwTDMValidDayIntervals,

                pwTDMLastEsTimeStamp,

                pwTDMCfgIndexNext,

                pwTDMCfgRowStatus,

                pwTDMCfgPayloadSize,
                pwTDMCfgPktReorder,
                pwTDMCfgRtpHdrUsed,
                pwTDMCfgJtrBfrDepth,
```

```
                pwTDMCfgPayloadSuppression,
                pwTDMCfgConsecPktsInSynch,
                pwTDMCfgConsecMissPktsOutSynch,
                pwTDMCfgSetUp2SynchTimeOut,

                pwTDMCfgPktReplacePolicy,

                pwTDMCfgAvePktLossTimeWindow ,
                pwTDMCfgExcessivePktLossThreshold,

                pwTDMCfgAlarmThreshold ,
                pwTDMCfgClearAlarmThreshold,
                pwTDMCfgMissingPktsToSes,

                pwTDMCfgTimestampMode,
                pwTDMCfgStorageType,
                pwTDMCfgPktFiller,
                pwTDMCfgName
                }
        STATUS  current
        DESCRIPTION
            "Collection of objects for basic TDM PW config and
             status."
        ::= { pwTDMGroups 1 }

   pwTDMPerfCurrentGroup OBJECT-GROUP
        OBJECTS {
                pwTDMPerfCurrentMissingPkts,
                pwTDMPerfCurrentPktsReOrder,
                pwTDMPerfCurrentJtrBfrUnderruns,
                pwTDMPerfCurrentMisOrderDropped,
                pwTDMPerfCurrentMalformedPkt,

                pwTDMPerfCurrentESs,
                pwTDMPerfCurrentSESs,
                pwTDMPerfCurrentUASs,
                pwTDMPerfCurrentFC
                }
        STATUS  current
        DESCRIPTION
            "Collection of current statistics objects for TDM PWs."
        ::= { pwTDMGroups 2 }

   pwTDMPerfIntervalGroup OBJECT-GROUP
        OBJECTS {
                pwTDMPerfIntervalValidData,
                pwTDMPerfIntervalDuration,
```

```
                pwTDMPerfIntervalMissingPkts,
                pwTDMPerfIntervalPktsReOrder,
                pwTDMPerfIntervalJtrBfrUnderruns,
                pwTDMPerfIntervalMisOrderDropped,
                pwTDMPerfIntervalMalformedPkt,

                pwTDMPerfIntervalESs,
                pwTDMPerfIntervalSESs,
                pwTDMPerfIntervalUASs,
                pwTDMPerfIntervalFC

        }
        STATUS   current
        DESCRIPTION
               "Collection of Interval statistics objects for TDM PWs."
        ::= { pwTDMGroups 3 }

    pwTDMPerf1DayIntervalGroup OBJECT-GROUP
        OBJECTS {
                pwTDMPerf1DayIntervalValidData,
                pwTDMPerf1DayIntervalDuration,
                pwTDMPerf1DayIntervalMissingPkts,
                pwTDMPerf1DayIntervalPktsReOrder,
                pwTDMPerf1DayIntervalJtrBfrUnderruns,
                pwTDMPerf1DayIntervalMisOrderDropped,
                pwTDMPerf1DayIntervalMalformedPkt,

                pwTDMPerf1DayIntervalESs,
                pwTDMPerf1DayIntervalSESs,
                pwTDMPerf1DayIntervalUASs,
                pwTDMPerf1DayIntervalFC
                }
        STATUS   current
        DESCRIPTION
               "Collection of Daily statistics objects for TDM PWs."
        ::= { pwTDMGroups 4 }

    END
```

9. Security Considerations

It is clear that this MIB module is potentially useful for monitoring
of TDM PWs. This MIB can also be used for configuration of certain
objects, and anything that can be configured can be incorrectly
configured, with potentially disastrous results.

There are a number of management objects defined in this MIB module
with a MAX-ACCESS clause of read-write and/or read-create. Such
objects may be considered sensitive or vulnerable in some network
environments. The support for SET operations in a non-secure
environment without proper protection can have a negative effect on
network operations. These are the tables and objects and their
sensitivity/vulnerability:

The pwTDMTable and pwTDMCfgTable contain objects of TDM PW parameters
on a Provider Edge (PE) device. Unauthorized access to objects in
these tables could result in disruption of traffic on the network.

The use of stronger mechanisms such as SNMPv3 security should be
considered where possible. Specifically, SNMPv3 VACM and USM MUST be
used with any SNMPV3 agent, which implements this MIB module.

Administrators should consider whether read access to these objects
should be allowed, since read access may be undesirable under certain
circumstances.

Some of the readable objects in this MIB module (i.e., objects with a
MAX-ACCESS other than not-accessible) may be considered sensitive or
vulnerable in some network environments. It is thus important to
control even GET and/or NOTIFY access to these objects and possibly
to even encrypt the values of these objects when sending them over
the network via SNMP. These are the tables and objects and their
sensitivity/vulnerability:

The pwTDMTable, pwTDMPerfCurrentTable, pwTDMPerfIntervalTable, and
pwTDMPerf1DayIntervalTable collectively show the TDM pseudowire
connectivity topology and its performance characteristics.

If an Administrator does not want to reveal this information, then
these tables should be considered sensitive/vulnerable.

SNMP versions prior to SNMPv3 did not include adequate security.
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/SET (read/change/create/delete) the objects
in this MIB module.

It is RECOMMENDED that implementers consider the security features as
provided by the SNMPv3 framework (see [RFC3410], section 8),
including full support for the SNMPv3 cryptographic mechanisms (for
authentication and privacy).

   Further, deployment of SNMP versions prior to SNMPv3 is NOT
   RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
   enable cryptographic security. It is then a customer/operator
   responsibility to ensure that the SNMP entity giving access to an
   instance of this MIB module is properly configured to give access to
   the objects only to those principals (users) that have legitimate
   rights to indeed GET or SET (change/create/delete) them.

10. IANA Considerations

   The MIB module in this document uses the following IANA-assigned
   OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

   Descriptor OBJECT IDENTIFIER value
   ---------- -----------------------

   pwTDMMIB   { mib-2 186 }

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12. Acknowledgements

   This document was produced by the PWE3 Working Group. Special thanks
   to Yaakov Stein, Doron Tzur, Sasha Vainshtein, and Ron Cohen for
   close review and good suggestions.

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