

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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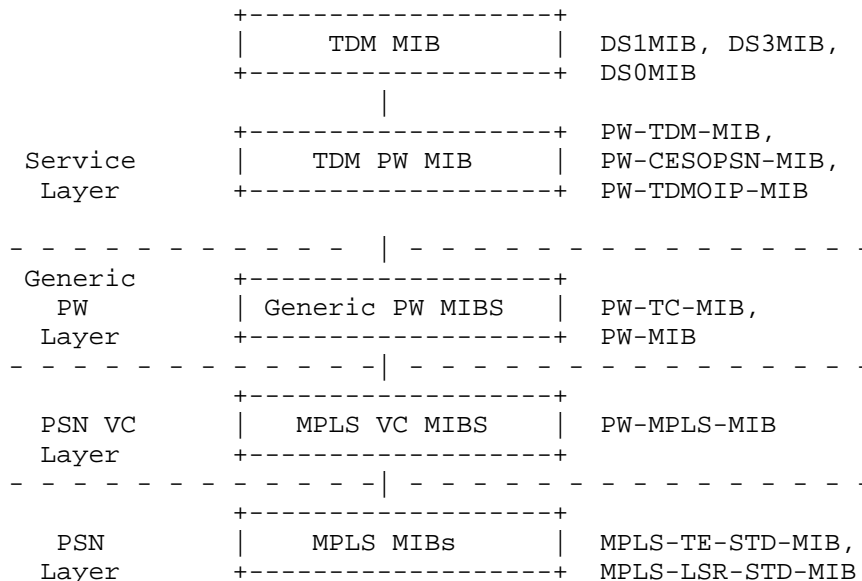
## 1. Introduction

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



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 (pwXXXXCfgTable, 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 pwXXXXCfgTable 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 pwXXXXCfgTable and in the pwTDMTable (suitable entries may already exist in both tables).
- Set the index of the relevant pwXXXXCfgTable 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 [PMMIB] 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 [PMMIB] and create a new pwTable entry using the value of pwIndexNext (assume here, the PW index = 20).
4. Set the pwType [PMMIB] 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

pwTDM MIB 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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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 pwXXXXCfgTable."

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 }

pwTDMPerfCurrentSESSs 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,

  pwTDMPerfIntervalESSs        PerfIntervalCount,
  pwTDMPerfIntervalSESSs       PerfIntervalCount,
  pwTDMPerfIntervalUASSs       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 }

pwTDMPerfIntervalSESSs 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 }

```

```
 ::= { pwTDMPerflDayIntervalTable 1 }
```

```
PwTDMPerflDayIntervalEntry ::= SEQUENCE {
    pwTDMPerflDayIntervalNumber      Unsigned32,
    pwTDMPerflDayIntervalValidData   TruthValue,
    pwTDMPerflDayIntervalDuration    Unsigned32,
    pwTDMPerflDayIntervalMissingPkts Counter32,
    pwTDMPerflDayIntervalPktsReOrder Counter32,
    pwTDMPerflDayIntervalJtrBfrUnderruns Counter32,
    pwTDMPerflDayIntervalMisOrderDropped Counter32,
    pwTDMPerflDayIntervalMalformedPkt Counter32,

    pwTDMPerflDayIntervaleSSs        Counter32,
    pwTDMPerflDayIntervalSESSs      Counter32,
    pwTDMPerflDayIntervalUASSs      Counter32,
    pwTDMPerflDayIntervalFC          Counter32
}
```

```
pwTDMPerflDayIntervalNumber 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."
```

```
 ::= { pwTDMPerflDayIntervalEntry 1 }
```

```
pwTDMPerflDayIntervalValidData OBJECT-TYPE
```

```
SYNTAX      TruthValue
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

```
DESCRIPTION
```

```
    "This variable indicates if the data for this interval
    is valid."
```

```
 ::= { pwTDMPerflDayIntervalEntry 2 }
```

```
pwTDMPerflDayIntervalDuration 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 }

pwTDMPerf1DayIntervaleESs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The counter associated with the number of Error
         Seconds encountered."
 ::= { pwTDMPerf1DayIntervalEntry 9 }

pwTDMPerf1DayIntervaleSESs 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,
    pwTDMPerfCurrentSESSs,
    pwTDMPerfCurrentUASSs,
    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,
        pwTDMPerfIntervalSEs,
        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,
        pwTDMPerf1DayIntervalSEs,
        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  
-----

pwTDMIB { mib-2 186 }

11. References

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