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Abstract

This memo defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for modeling Native Service Processing of SONET/SDH circuits over a Packet Switch Network (PSN).
1 Introduction

This document describes a model for managing encapsulated SONET Time Division Multiplexed (TDM) digital signals for transmission over a Packet Switched Network (PSN).

This document is closely related to [CEP], which describes the technology to encapsulate TDM signals and provide the Circuit Emulation Service over a Packet Switched Network (PSN).

The model for CEP management is a MIB module. The CEP MIB module described in this document works closely with the MIB modules described in [PWMIB] and the textual conventions defined in [PWTC]. In the spirit of the [RFC3592], a CEP connection will be a pseudo-wire (PW), and will therefore not be represented in the ifTable.

CEP is currently specified to carry "structured" SONET paths, meaning that each SONET PATH/VT within the section/line/path can be processed separately. The SONET section/line/path interface stack is modeled within [RFC3592].

Comments should be made directly to PWE3 group at pwe3@ietf.org.

This memo does not, in its draft form, specify a standard for the Internet community.

Conventions used in this document

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].

2 Terminology

CEP terminology comes from the CEP draft that describes a mechanism for transporting SONET Time Division Multiplexed (TDM) digital
signals over a packet-oriented network. The mechanism for structured (as outlined in the CEP draft) terminates the SONET section and line overhead and then breaks the SONET path’s Synchronous Payload Envelope (SPE) into fragments for transmission over a PSN. Mechanism for terminating of the SONET path overhead and extracting SONET VTs are also described in [CEP]. Mechanisms for Fractional SONET SPE emulation are described in [CEP]. A CEP header is appended at the beginning of each fragment to provide information regarding where the SPE begins within the packet stream, a sequence number, and pointer adjustment information (see [CEP]).

"Outbound" references the traffic direction where a SONET path’s payload (SPE) is received, adapted to packet, assigned a PW label, and sent into the PSN.

Conversely, "inbound" is the direction where packets are received from the PSN, packet payloads are reassembled back into an SPE, and inserted as a SONET path into the SONET section and line.

Since a SONET path is bi-directional and symmetrical, it uses the same SONET time-slot, SONET width and packet size. Inbound and outbound PW labels may differ.

CEP will normally transmit into an originating "head" end of a PSN’s tunnel, and receive from a terminating "tail" end a PSN’s tunnel. In the case of an MPLS PSN, a CEP connection typically uses a PW Label within a Tunnel Label [PW-SIG]. Multiple CEP PWS each with a unique PW Label and similar traffic engineering requirements can share the same PSN tunnel. For MPLS PSNs, the Tunnel Label is known as the "outer" Label, while the PW Label is known as the "inner" Label. An exception to this is with adjacent MPLS LSRs. In this case, there is an option for CEP PWS to connect directly without an outer Label.

3 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].

4 CEP MIB architecture

The CEP MIB is part of the PW MIB modules architecture, as described in [PWMIB], and serves as one of the PW type-specific MIB module

For clarity of the description below, in most cases we refer to the PATH SONET signal configuration only. When configuring VT mode as
described in [CEP], the same apply for the VT level.

1.1 Summary of CEP MIB

- The CEP PW Table (pwCepTable) contains the SONET Path/VT ifIndex, SONET Path Time slot, the pwCepCfgTable index, config error indications, and various status indications.

- The CEP PW Configuration Parameter Table (pwCepCfgTable) has objects for CEP PW configuration. In situations where sets of config objects are common amongst more than 1 CEP PW, a single entry here may be referenced by many pwCepTable entries.

- The CEP Performance Current Table (pwCemPerfCurrentTable) contains CEP stats for the current 15-minute period.

- The CEP Performance Interval Table (pwCemPerfIntervalTable) is similar to the pwCemPerfCurrentTable. It contains historical intervals (usually 96 15-minute entries to cover a 24 hour period).

Note: the performance interval statistics are supported by CEP due to the very function of CEP - that is, processing SONET. See [RFC3592].

- The CEP Performance Total Table (pwCepPerfTotalTable) is similar to the pwCemPerfCurrentTable. It contains statistics accumulated since the CEP PW was first established.

- The CEP Fractional Table (pwCepFracTable) adds configuration and monitoring parameters for fractional SPE PWs.

- The Conformance Config Table (pwCepConformanceCfgTable) allows the vendor to specify the extent to which certain objects are supported (or not).

1.2 CEP configuration Step by Step

Configuring a CEP PW involves the following steps.

First create an entry in the pwTable and configure the PSN tunnels:

- Follow steps as defined in [PWMIB].

Configure the SONET Path parameters:

- Set the SONET path width in the sonetPathCurrentTable [RFC3592].

- Set the SONET path index and the SONET path starting time slot in the pwCepTable.

NOTE: The agent will have created an entry in the pwCepTable based on the entry created in the pwTable.

Configure the CEP PW:

- If necessary, create an entry in the pwCepCfgTable (a suitable entry may already exist). Set packet length, etc.
- Set the index of this pwCepCfgTable entry in the pwCepTable.

Observe the CEP PW:

- Once a CEP PW is operational, the pwCepPerfCurrentTable, pwCepPerfIntervalTable, and pwCepPerfTotalTable are used to monitor the various counts, indicators, and conditions of the PW.

Conforming to the CEP MIB objects:

- The pwCepConformanceCfgTable is used to state True/False whether certain objects are supported. An ASCII string object is available with every True/False object as a means to explain the extent of ‘true’ support, or perhaps explain why the ‘false’ was set.

Example of CEP PW Setup

In this section we provide an example of using the MIB objects described in section 8 to set up a CEP PW (width of 3 STSs, starting at time slot 1). While this example is not meant to illustrate every permutation of the MIB, it is intended as an aid to understanding some of the key concepts. It is meant to be read after going through the MIB itself. See [PWMIB] for an example of setting up PSN Tunnels.

First configure the SONET path width, starting time-slot, and associated CEP PW. In this case, an STS-3c starts at SONET time slot 1 (and is distributed normally within the SONET frame). In the following example, the ifIndex for the sonetPathCurrentEntry is 23, while the pwCepCfgTable index is 9.

In [RFC3592] sonetPathCurrentEntry (ifIndex = 23) :

```diff
{  
    sonetPathCurrentWidth     = 3,
    sonetPathCurrentStatus
```
Create an entry in the pwCepCfgTable (index = 9):
{
    pwCepCfgSonetPayloadLength = 783 -- payload bytes
    pwCepCfgMinPktLength = 0 -- no minimum
    pwCepCfgPktReorder = true
    pwCepCfgEnableDBA = unequipped
    pwCepCfgRtpHdrSuppress = false
    pwCepCfgJtrBfrDepth = 500 -- micro-seconds
    pwCepCfgConsecPktsInsync = 2 -- Exit LOPS state
    pwCepCfgConsecMissingOutSync = 10 -- Enter LOPS state
    pwCepCfgPktErrorPlayOutValue = 0xFF -- All ones
    pwCepCfgMissingPktsToSes = 3 -- packets,
    pwCepCfgSesToUas = 2 -- seconds,
    pwCepCfgSecsToExitUas = 10 -- seconds,
    pwCepCfgRowStatus = createAndGo
}

Check that there is no error bit set in pwCepConfigError.

In the PW MIB module: Get a new index and create a new pwTable entry using pwIndexNext (here, the PW index = 83) and pwRowStatus. In this new entry, set pwType to ‘cep’. This should create a new entry in the pwCepTable. Set up and the SONET path ifIndex, SONET path time slot, and Cfg Table indexes within this new pwCep table entry:
{
    pwCepSonetIfIndex = 23 -- Index of associated entry
                        -- in sonetPathCurrent table.
    pwCepCfgIndex = 9 -- Index of associated entry
                        -- in pwCepCfg table (above).
}

Verify that none of the error bits are set in pwCepSonetConfigError.
This MIB module contains managed object definitions for...
Circuit Emulation over Packet (CEP) as in: Malis, A., Prayson, P., Cohen, R. and Zelig, D. ’SONET/SDH Circuit Emulation Over Packet (CEP)’, RFC yyyy

-- RFC Ed.: replace yyyy with actual RFC number & remove this note

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-- RFC Ed.: replace yyyy with actual RFC number & remove this note

::= { pwStdMIB xxxx } -- To be assigned by IANA
   -- the value 5 is requested for this
   -- specific Module.

-- Local Textual conventions

PwCepCfgIndex ::= TEXTUAL-CONVENTION
  STATUS    current
  DESCRIPTION
    "Index into the pwCepCfgTable."
  SYNTAX   Unsigned32

PwCepSonetEbm ::= TEXTUAL-CONVENTION
  STATUS    current
  DESCRIPTION
    "Equipped Bit Mask (EBM) used for fractional STS-1/VC-3. The EBM bits are the 28 least significant bits out of the 32 bit value"
  SYNTAX   Unsigned32

PwCepSdhVc4Ebm ::= TEXTUAL-CONVENTION
  STATUS    current
  DESCRIPTION
    "Equipped Bit Mask (EBM) used for each TUG-3 in fractional VC-4 circuits. The EBM bits are the 30 least significant bits out of the 32 bit value"
  SYNTAX   Unsigned32

PwCepSonetVtgMap ::= TEXTUAL-CONVENTION
  STATUS    current
  DESCRIPTION
    "The VT/VC types carried in the 7 VTG/TUG-2s. The format is 28 bits in the form of an Equipped Bit Mask (EBM) for fractional STS-1/VC-3. The mapping specifies the maximal occupancies of VT/VC within each VTG/TUG-2. For example, all four bits are set to 1 in this objects it represents a VTG carrying VT1.5/VC11s, while only three are set when VT2/VC12 are carried within this VTG. The relevant bits are the 28 least significant bits out of the 32 bit value."
  SYNTAX   Unsigned32

PwCepFracAsyncMap ::= TEXTUAL-CONVENTION
  STATUS    current
  DESCRIPTION
    "The type of Asynchronous mapping carried inside STS-1, VC-3
or TUG-3 containing TU-3 circuit. The value of 'other' MUST be used if the Use of this object is not applicable.

SYNTAX INTEGER {
  other ( 1),
  ds3   ( 2),
  e3    ( 3)
}

-- Top level components of this MIB module.

-- Tables, Scalars
pwCepObjects OBJECT IDENTIFIER ::= { pwCepMIB 1 }

-- Conformance
pwCepConformance OBJECT IDENTIFIER ::= { pwCepMIB 2 }

-- CEP PW table

pwCepTable OBJECT-TYPE
SYNTAX        SEQUENCE OF PwCepEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"This table contains objects and parameters for managing and monitoring the CEP PW."
 ::= { pwCepObjects 1 }

pwcepEntry OBJECT-TYPE
SYNTAX        PwCepEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"Each entry represents the association of a SONET/SDH PATH or VT to a PW. This table is indexed by the pwIndex of the applicable PW entry in the pwTable.

An entry is created in this table by the agent for every entry in the pwTable with a pwType of ‘cep’.

INDEX  { pwIndex }

 ::= { pwCepTable 1 }

PwCepEntry ::= SEQUENCE {
  pwCepType                       INTEGER,
  pwCepSonetIfIndex               InterfaceIndexOrZero,
  pwCepSonetConfigErrorOrStatus   BITS,
  pwCepCfgIndex                   PwCepCfgIndex,
  pwCepTimeElapsed                HCPerfTimeElapsed,
  pwCepValidIntervals             HCPerfValidIntervals,
  pwCepCurrentIndications         BITS,
  pwCepLatchedIndications         BITS,
pwCepLastEsTimeStamp  TimeStamp,
pwCepPeerCepOption    Unsigned32
}

pwCepType OBJECT-TYPE
SYNTAX    INTEGER {
    spe    (1),
    vt     (2),
    fracSpe (3)
}
MAX-ACCESS read-write
STATUS    current
DESCRIPTION
"Specifies the sub-type of CEP PW. Currently only structured types are supported:

'spe'(1) : SONET STS-Nc signals.
'vt' (2) : SONET VT-x (x=1.5,2,3,6) signals.
'fracSpe' (3) : SONET fractional STS-1 or SDH fractional VC-3 or VC-4 carrying tributaries or Asynchronous signals.

Support of 'vt' mode or 'fracSpe' mode is optional."

::= { pwCepEntry 1 }

pwCepSonetIfIndex OBJECT-TYPE
SYNTAX    InterfaceIndexOrZero
MAX-ACCESS read-write
STATUS    current
DESCRIPTION
"This is a unique index within the ifTable. It represents the interface index for the SONET path for SPE emulation (RFC3593 section 3.3), an interface index for the SONET VT (RFC3593 section 3.4) if the VT to be emulated is extracted a SONET signal or locally mapped from a physical interface.

A value of zero indicates an interface index that has yet to be determined.
Once set, if the SONET ifIndex is (for some reason) later removed, the agent MAY delete the associated PW rows (e.g., this pwCep table entry). If the agent does not delete the rows, it is recommended that the agent set this object to zero."

::= { pwCepEntry 2 }

pwCepSonetConfigErrorOrStatus OBJECT-TYPE
SYNTAX    BITS {
    other     ( 0),
    timeslotInUse     ( 1),
    timeslotMisuse    ( 2),
    
::= { pwCepEntry 3 }

::= { pwCepEntry 4 }

::= { pwCepEntry 5 }
peerDbaIncompatible ( 3), -- Status Only
peerEbmIncompatible ( 4),
peerRtpIncompatible ( 5),
peerPidIncompatible ( 6),
peerAsyncIncompatible ( 7)
}
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"This object report a configuration mismatch inside
the local node or between the local node and the peer node.
Some bits indicate an error and some are simply a status
report that does not affect the forwarding process.

'timeslotInUse'(1) is set when another CEP PW has already
reserved a timeslot(s) that this CEP PW is attempting to
reserved.

'timeslotMisuse'(2) is set when the stated timeslot this
PW is trying to use is not legal. For example, if
specifying a starting timeslot of 45 for a SONET path of
an STS-12c width.

The peerIncompatible bits are set if the local configuration
is not compatible with the peer configuration as available
from the CEP option received through the signaling process
from the peer."

REFERENCE
(CEP), RFC yyyy, section 11. "
-- RFC Editor: Please replace yyyy with the RFC number and remove
-- this remark
::= { pwCepEntry 3 }

pwCepCfgIndex OBJECT-TYPE
SYNTAX        PwCepCfgIndex
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
"Index to CEP configuration table below. Multiple CEP PWs
MAY share a single pwCepCfgEntry."
::= { pwCepEntry 4 }

pwCepTimeElapsed OBJECT-TYPE
SYNTAX  HCPerfTimeElapsed
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."
::= { pwCepEntry 5 }

pwCepValidIntervals OBJECT-TYPE
SYNTAX  HCPerfValidIntervals
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
"The number of previous 15-minute intervals for which data was collected.
An agent with CEP 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."

::= { pwCepEntry 6 }

pwCepCurrentIndications OBJECT-TYPE

SYNTAX BITS {
  missingPkt  ( 0),
  ooRngDropped( 1),
  jtrBfrUnder ( 2),
  pktBadLength( 3),
  lops     ( 4),
  cepRdi    ( 5),
  cepAis    ( 6),
  badHdrStack ( 7),
  cepNeFailure( 8),
  cepFeFailure( 9)
}
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Definitions:

'missingPkt'(0) - While playing out a sequence of packets, a packet(s) was determined to be missing based on a gap in the CEP sequence number. Note: If the implementation supports packet re-ordering, detecting gaps should not take place as packets arrive, only as they are played out - this gives time for mis-ordered packets to arrive late.

'ooRngDropped'(1) - Packet(s) arrives that is outside the range of the jitter buffer. This may be because the jitter buffer is full, or the sequence number addresses a buffer outside the current jitter buffer range, or addresses an already occupied buffer within range. Whether or not packet re-ordering is supported by the implementation, this indication MUST be supported.

'jtrBfrUnder'(2) - The jitter buffer underflowed due to not enough packets arriving as packets were being played out.

'pktBadLength'(3) - Non-bandwidth-saving packet arrives larger or smaller than pwCepCfgSonetPayloadLength, or when a fractional SPE packet length does not match the extension header or manual configuration indicating the number of
equipped VTs.

’lops’(4) - Loss Of Packet Synchronization.

’cepRdi’(5) - Circuit Emulation over Packet Remote Defect Indication. Generated by the remote CEP de-packetizer when detecting LOPS. Note: not generated by the remote SONET function. See draft-ietf-pwe3-sonet.

’cepAis’(6) - Remote CEP packetizer has detected AIS on its incoming SONET stream. Note: cepAis MUST NOT (in itself) cause a CEP down notification.

’badHdrStack’(7) - This indication is set when the number of CEP header extensions detected in incoming packets does not match the expected number.

’cepNeFailure’(8) - Set when CEP-NE failure is currently declared.

’cepFeFailure’(8) - Set when CEP-FE failure is currently declared.

Note: currently there is no hierarchy of CEP defects.

Note: the algorithm used to capture these indications is implementation specific."

::= { pwCepEntry 7 }

pwCepLatchedIndications OBJECT-TYPE
SYNTAX BITS {
    missingPkt  ( 0),
    ooRngDropped( 1),
    jtrBfrUnder  ( 2),
    pktBadLength( 3),
    lops        ( 4),
    cepRdi      ( 5),
    cepAis      ( 6),
    badHdrStack ( 7),
    cepNeFailure( 8),
    cepFeFailure( 9)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The state of CEP indicators when the CEP PW last declared errored second (either as ES, SES or a second with errors inside a UAS) condition. At this time, only LOPS can create a failure. Since indicators other than LOPS are useful, all are latched here. For bit definitions, see pwCepCurrentIndications above.

Note: the algorithm used to latch these indications when entering an defect state is implementation specific."

::= { pwCepEntry 8 }
pwCepLastEsTimeStamp OBJECT-TYPE  
SYNTAX      TimeStamp  
MAX-ACCESS  read-only  
STATUS      current  
DESCRIPTION  
"The value of sysUpTime on the most recent occasion at which the CEP PW entered the ES or SES state."

::= { pwCepEntry 9 }

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pwCepPeerCepOption OBJECT-TYPE  
SYNTAX      Unsigned32  
MAX-ACCESS  read-only  
STATUS      current  
DESCRIPTION  
"The value of CEP option parameter as received from the peer by the PW signaling protocol."

::= { pwCepEntry 10 }

-- End of CEP PW table

-- Obtain index for PW CEP Configuration table entries

pwCepCfgIndexNext OBJECT-TYPE  
SYNTAX            PwCepCfgIndex  
MAX-ACCESS        read-only  
STATUS            current  
DESCRIPTION  
"This object contains an appropriate value to be used for pwCepCfgIndex when creating entries in the pwCepCfgTable. The value 0 indicates that no unassigned entries are available. To obtain the value of pwCepCfgIndex for a new entry in the pwCepCfgTable, the manager issues a management protocol retrieval operation to obtain the current value of pwCepCfgIndex. After each retrieval operation, the agent should modify the value to reflect the next unassigned index. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { pwCepObjects 2 }

-- PW CEP PW Configuration Table

pwCepCfgTable   OBJECT-TYPE  
SYNTAX                  SEQUENCE OF PwCepCfgEntry  
MAX-ACCESS              not-accessible  
STATUS                  current  
DESCRIPTION  
"This table contains a set of parameters that may be referenced by one or more CEP PWs by pwCepTable."
pwCepCfgEntry OBJECT-TYPE
SYNTAX PwCepCfgEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "These parameters define the characteristics of a
CEP PW. They are grouped here to ease NMS burden.
Once an entry is created here it may be re-used
by many PWs."
INDEX { pwCepCfgTableIndex }

::= { pwCepCfgTable 1 }

PwCepCfgEntry ::= SEQUENCE {
  pwCepCfgTableIndex PwCepCfgIndex,
  pwCepConfigError BITS,
  pwCepSonetPayloadLength Unsigned32,
  pwCepCfgMinPktLength Unsigned32,
  pwCepCfgPktReorder TruthValue,
  pwCepCfgEnableDBA BITS,
  pwCepCfgRtpHdrSuppress TruthValue,
  pwCepCfgJtrBfrDepth Unsigned32,
  pwCepCfgConsecPktsInsync Unsigned32,
  pwCepCfgConsecMissingOutSync Unsigned32,
  pwCepCfgPktErrorPlayOutValue Unsigned32,
  pwCepCfgMissingPktsToSes Unsigned32,
  pwCepCfgSesToUas Unsigned32,
  pwCepCfgSecsToExitUas Unsigned32,
  pwCepCfgRowStatus RowStatus,
  pwCepCfgStorageType StorageType
}

pwCepCfgTableIndex OBJECT-TYPE
SYNTAX PwCepCfgIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Primary index to this table"
::= { pwCepCfgEntry 1 }

pwCepConfigError OBJECT-TYPE
SYNTAX BITS {
  other  ( 0),
  dba    ( 1),
  lopsPktCount ( 2),
  pktLength  ( 3),
  jtrBfrDepth ( 4)
Various configurations errors, detected when a configured value within the pwCepCfg or pwCepSonetExt tables cannot be supported by the local agent.

::= { pwCepCfgEntry 2 }

pwCepSonetPayloadLength OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The number of SONET bytes of the Path or VT carried as payload within one packet. For example, for STS-1/VC-3 SPE circuits, value of 783 bytes indicates that each packet carries payload equivalent to one frame. For VT1.5/VC11 circuits, a payload length of 104 bytes indicates that each packet carries payload equivalent to one VT1.5 super-frame. The actual payload size may be different, due to bandwidth reduction modes, e.g. DBA mode or dynamically assigned fractional SPE. This length applies to inbound and outbound packets carrying user payload. Although there is no control over inbound packets, those of illegal length are discarded and accounted for (see pwCepPerf...PktsBadLength.) The default values are determined by the pwCepType: 783 for pwCepType equal spe(2) or fracSpe(3). For vt(3) modes, the applicable super-frame payload size is the default value."  

REFERENCE
"Malis, A., et al, 'SONET/SDH Circuit Emulation over Packet (CEP), RFC yyyy, sections 4.1 and 10.2"

::= { pwCepCfgEntry 3 }

pwCepCfgMinPktLength OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"This is the minimum CEP packet length in number of bytes (including CEP header and payload). It applies to CEP's bandwidth-savings packets. Currently DBA is the only bandwidth-savings packet type (in the future, CEP may support compression). Minimum packet length is necessary in some systems or networks. Setting Zero here indicates that there is no minimum packet restriction."

DEFVAL
::= { pwCepCfgEntry 4 }

**pwCepCfgPktReorder** OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"If set ‘true’: as inbound 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 dependent on the depth of the jitter buffer.

If the local agent support packet re-ordering, the default value SHOULD be set to ‘true’, Otherwise, this value SHOULD be set to ‘false’.
"

::= { pwCepCfgEntry 5 }

**pwCepCfgEnableDBA** OBJECT-TYPE

SYNTAX BITS {
  ais        (0),
  unequipped (1)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Bits set here MUST enable the DBA (dynamic bandwidth allocation) feature for the specified condition. Setting ‘ais’ MUST cause CEP packet payload suppression when AIS is detected on the associated SONET path. Similarly, ‘unequipped’ MUST cause payload suppression when an un-equipped condition is detected on the SONET/SDH PATH/VT. During these conditions, CEP packets will continue to be sent, but with indicators set in the CEP header instructing the remote to play all ones (for AIS) or all zeros (for un-equipped) onto its SONET path.

NOTE: Some implementations may not support this feature. In these cases, this object should be read-only."

REFERENCE

-- RFC Editor: Please replace yyyy with the RFC number and remove this remark

::= { pwCepCfgEntry 6 }

**pwCepCfgRtpHdrSuppress** OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-create
STATUS  current
DESCRIPTION  "If set True: an RTP header is not pre-pended to the CEP packet."
REFERENCE  "Malis, A., et al, 'SONET/SDH Circuit Emulation over Packet (CEP), RFC yyyy, section 4.3." -- RFC Editor: Please replace yyyy with the RFC number and remove this remark
DEFVAL  { false }

::= { pwCepCfgEntry 7 }

pwCepCfgJtrBfrDepth OBJECT-TYPE
SYNTAX        Unsigned32
UNITS         "micro-seconds"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "This setting configures the number of microseconds of expected packet delay variation for this CEP PW over the PSN.

The actual jitter buffer MUST be at least twice this value for proper operation, and is implementation specific.

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

::= { pwCepCfgEntry 8 }

-- The following counters work together to integrate (filter) errors and the lack of errors on the CEP PW. An error is caused by a missing packet. 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 CEP PW is in Loss of Packet Sync (LOPS) state.

pwCepCfgConsecPktsInsync OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "Consecutive pkts with sequential sequence numbers required to exit the LOPS state."
REFERENCE  "Malis, A., et al, 'SONET/SDH Circuit Emulation over Packet (CEP), RFC yyyy, section 5.2.2." -- RFC Editor: Please replace yyyy with the RFC number and remove this remark
DEFVAL
   { 2 }
::= { pwCepCfgEntry 9 }

pwCepCfgConsecMissingOutSync OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Consecutive missing pkts required to enter
the LOPS state."
REFERENCE
   (CEP), RFC yyyy, section 5.2.2. "
-- RFC Editor: Please replace yyyy with the RFC number and remove
-- this remark
DEFVAL
   { 10 }
::= { pwCepCfgEntry 10 }

pwCepCfgPktErrorPlayOutValue OBJECT-TYPE
SYNTAX Unsigned32 (0..255)
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This is the value played when inbound packets have
over/underflowed the jitter buffer, or are missing
for any reason. This byte pattern is sent (played) on
the SONET path."
DEFVAL
   { 255 } -- Play all ones, equal to AIS indications.
::= { pwCepCfgEntry 11 }

pwCepCfgMissingPktsToSes OBJECT-TYPE
SYNTAX Unsigned32
UNITS "seconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Number of missing packets detected (consecutive or not)
within a 1 second window to cause a Severely Errored
Second (SES) to be counted."
REFERENCE
   (CEP), RFC yyyy, section 9.1. "
-- RFC Editor: Please replace yyyy with the RFC number and remove
-- this remark
DEFVAL
   { 3 }
::= { pwCepCfgEntry 12 }

pwCepCfgSesToUas OBJECT-TYPE
SYNTAX Unsigned32
UNITS "seconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"Number of consecutive SESs before declaring PW in UAS state (and at which point pwCepPerfUASs starts counting). The SesToUas default value is 10 seconds.

NOTE: Similar to RFC 3592, If the agent chooses to update the various performance statistics in real time then it must be prepared to retroactively reduce the ES, SES, counts by this value and increase the UAS count by this value when it determines that UAS state has been entered.

NOTE: See pwCepPerfSESs and pwCepPerfUASs."

REFERENCE


-- RFC Editor: Please replace yyyy with the RFC number and remove this remark

DEFVAL

{ 10 }

::= { pwCepCfgEntry 13 }

pwCepCfgSecsToExitUas OBJECT-TYPE
SYNTAX Unsigned32
UNITS "seconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Number of consecutive nonSESs before declaring PW is NOT in UAS state (and at which point pwCepPerfUASs stops counting)."

REFERENCE


-- RFC Editor: Please replace yyyy with the RFC number and remove this remark

DEFVAL

{ 10 }

::= { pwCepCfgEntry 14 }

pwCepCfgRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"For creating, modifying, and deleting this row.

None of the read-create objects values can be changed when pwCepCfgRowStatus is in the active(1) state. Changes are allowed when the pwRowStatus is in notInService(2) or notReady(3) states only.

If the operator need to change one of the values for an active row (for example in order to fix a mismatch in configuration between the local node and the peer), the pwCepCfgRowStatus should be first changed to notInService(2), the objects may be changed now, and later to active(1) in order to re-initiate the signaling process.
with the new values in effect.

Change of status from the active(1) state or deleting a row
SHOULD be blocked by the local agent if the row is
referenced by any pwCepEntry those pwRowStatus
is in the active(1) state."

 ::= { pwCepCfgEntry 16 }

pwCepCfgStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This variable indicates the storage type for this
row."
 ::= { pwCepCfgEntry 15 }

-- End of CEP PW Configuration Parameter Table

-- Fractional CEP Configuration Table

pwCepFracTable OBJECT-TYPE
SYNTAX SEQUENCE OF PwCepFracEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains a set of parameters for CEP PWs with
pwCepType FRAC type."
 ::= { pwCepObjects 4 }

pwCepFracEntry OBJECT-TYPE
SYNTAX PwCepFracEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An entry of this table can be created in two options:
- By the EMS in advance for creating the PW.
- By the agent automatically when the PW is set up.

The first option is typically used when there is an NSP
cross-connect option between the physical ports and the
emulated (virtual ports), while the second MAY be used
when there is a one-to-one mapping between the emulated
signal and the physical signal."

INDEX { pwCepFracIndex }

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 ::= { pwCepFracTable 1 }

PwCepFracEntry ::= SEQUENCE {
    pwCepFracIndex InterfaceIndex,
    pwCepFracMode INTEGER,
    pwCepFracConfigError BITS,
pwCepFracAsync          PwCepFracAsyncMap,
pwCepFracVtgMap         PwCepSonetVtgMap,
pwCepFracEbm           PwCepSonetEbm,
pwCepFracPeerEbm       PwCepSonetEbm,
pwCepFracSdhVc4Mode    INTEGER,
pwCepFracSdhVc4Tu3Map1 PwCepFracAsyncMap,
pwCepFracSdhVc4Tu3Map2 PwCepFracAsyncMap,
pwCepFracSdhVc4Tu3Map3 PwCepFracAsyncMap,
pwCepFracSdhVc4Tug2Map1 PwCepSonetVtgMap,
pwCepFracSdhVc4Tug2Map2 PwCepSonetVtgMap,
pwCepFracSdhVc4Tug2Map3 PwCepSonetVtgMap,
pwCepFracSdhVc4Ebm1     PwCepSdhVc4Ebm,
pwCepFracSdhVc4Ebm2     PwCepSdhVc4Ebm,
pwCepFracSdhVc4Ebm3     PwCepSdhVc4Ebm,
pwCepFracSdhVc4PeerEbm1 PwCepSdhVc4Ebm,
pwCepFracSdhVc4PeerEbm2 PwCepSdhVc4Ebm,
pwCepFracSdhVc4PeerEbm3 PwCepSdhVc4Ebm,
pwCepFracRowStatus      RowStatus,
pwCepFracStorageType    StorageType

}
payload.
staticAsync - Asynchronous E3/T3 fixed byte removal only."

DEFVAL
  { dynamic } ::= { pwCepFracEntry 2 }

pwCepFracConfigError OBJECT-TYPE
SYNTAX BITS {
  other               ( 0),
  vtgMapEbmConflict   ( 1),
  vtgMapAsyncConflict ( 2)
}
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"vtgMapEbmConflict is set when the configured static EBM
does not match the configured vtgMap for fractional
STS-1/VC-3 circuits, or when the TUG2Map is in conflict with
the static EBM for VC-4 circuits. For example, if the vtgMap
specifies that VTG#1 carries VT2 VTs while the EBM indicate
that four VTs are equipped within VTG#1.
vtgMapAsyncConflict is set when there is a conflict between
the mode, the async indication and the vtgMap fields. For
example, fractional mode is set to Static Async while the
VtgMap indicate that the STS-1/VC-3 carries VTs. Or in
fractional VC-4 circuits both async1 and Tug2Map are set."

 ::= { pwCepFracEntry 3 }

pwCepFracAsync OBJECT-TYPE
SYNTAX PwCepFracAsyncMap
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The Asynchronous payload carried within the STS-1/VC-3.
This variable should be set when 'staticAsync' Fractional
STS-1/VC-3 pwCepFracMode is selected, and hold the value
of 'other' otherwise."

DEFVAL

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  { other } ::= { pwCepFracEntry 4 }

pwCepFracVtgMap OBJECT-TYPE
SYNTAX      PwCepSonetVtgMap
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
"The VT/VC types of the seven VTG/TUG-2 within the
STS-1/VC-3.
This variable should be set when 'dynamic', 'static'
or 'staticWithEbm' Fractional STS-1/VC-3 pwCepFracMode
is selected. "

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pwCepFracEbm OBJECT-TYPE
SYNTAX     PwCepSonetEbm
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"Static Equipped Bit Mask (EBM) for STS-1/VC-3 channel. This variable MAY be set when 'static' or 'staticWithEbm' Fractional STS-1/VC-3 pwCepFracMode is selected.
It is possible that the EBM that would be used is available based on configuration of other MIB modules. In these cases this object is read-only and reflects the actual EBM that would be used."

pwCepFracPeerEbm OBJECT-TYPE
SYNTAX     PwCepSonetEbm
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Equipped Bit Mask (EBM) for STS-1/VC-3 channel received from the peer within the CEP extension header."

pwCepFracSdhVc4Mode OBJECT-TYPE
SYNTAX     INTEGER {
            notApplicable ( 1),
            dynamic       ( 2),
            static        ( 3),
            staticWithEbm ( 4)
        }
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"Fractional mode for VC-4 circuits:
notApplicable - When this is not VC-4 circuit.
dynamic - EBM carried within the CEP header. Unequipped VTs are removed from the payload on the fly.
static - EBM not carried within the CEP header. Only VTs defined in the EBM are carried within the payload.
staticWithEbm - EBM carried within the CEP header. Only VTs defined in the EBM are carried within the payload."
DEFVAL
{ notApplicable }

::= { pwCepFracEntry 8 }
pwCepFracSdhVc4Tu3Map1 OBJECT-TYPE
SYNTAX PwCepFracAsyncMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION "If the first TUG-3 within the VC-4 contains a TU-3, this variable must be set to the required mode."
DEFVAL { other }
 ::= { pwCepFracEntry 9 }

pwCepFracSdhVc4Tu3Map2 OBJECT-TYPE
SYNTAX PwCepFracAsyncMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION "If the second TUG-3 within the VC-4 contains a TU-3, this variable must be set."
DEFVAL { other }
 ::= { pwCepFracEntry 10 }

pwCepFracSdhVc4Tu3Map3 OBJECT-TYPE
SYNTAX PwCepFracAsyncMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION "If the third TUG-3 within the VC-4 contains a TU-3, this variable must be set."
DEFVAL { other }
 ::= { pwCepFracEntry 11 }

pwCepFracSdhVc4Tug2Map1 OBJECT-TYPE
SYNTAX PwCepSonetVtgMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The VC types of the seven TUG-2 within the first TUG-3 of the VC-4."
 ::= { pwCepFracEntry 12 }

pwCepFracSdhVc4Tug2Map2 OBJECT-TYPE
SYNTAX PwCepSonetVtgMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The VC types of the seven TUG-2 within the second TUG-3 of the VC-4."

::= { pwCepFracEntry 13 }

pwCepFracSdhVc4Tug2Map3 OBJECT-TYPE
SYNTAX PwCepSonetVtgMap
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The VC types of the seven TUG-2 within the third TUG-3 of the VC-4."

::= { pwCepFracEntry 14 }

pwCepFracSdhVc4Ebm1 OBJECT-TYPE
SYNTAX PwCepSdhVc4Ebm
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Static Equipped Bit Mask (EBM) for first TUG-3 within the VC-4.
This variable should be set when 'static' or 'staticWithEbm' Fractional VC-4 pwCepFracMode is selected.
It is possible that the EBM that would be used is available based on configuration of other MIB modules.
In these cases this object is read-only and reflects the actual EBM that would be used."

::= { pwCepFracEntry 15 }

pwCepFracSdhVc4Ebm2 OBJECT-TYPE
SYNTAX PwCepSdhVc4Ebm
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Static Equipped Bit Mask (EBM) for second TUG-3 within the VC-4.
This variable should be set when 'static' or 'StaticWithEbm' Fractional VC-4 pwCepFracMode is selected.
It is possible that the EBM that would be used is available based on configuration of other MIB modules.
In these cases this object is read-only and reflects the actual EBM that would be used."

::= { pwCepFracEntry 16 }

pwCepFracSdhVc4Ebm3 OBJECT-TYPE
SYNTAX PwCepSdhVc4Ebm
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Static Equipped Bit Mask (EBM) for third TUG-3 within the VC-4.
This variable should be set when 'Static' or 'staticWithEbm' Fractional VC-4 pwCepFracMode is selected."
It is possible that the EBM that would be used is available based on configuration of other MIB modules. In these cases this object is read-only and reflects the actual EBM that would be used.

::= { pwCepFracEntry 17 }

pwCepFracSdhVc4PeerEbm1 OBJECT-TYPE
SYNTAX        PwCepSdhVc4Ebm
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Equipped Bit Mask (EBM) for the first TUG-3 within the fractional VC-4 channel received from peer within the CEP extension header."

::= { pwCepFracEntry 18 }

pwCepFracSdhVc4PeerEbm2 OBJECT-TYPE
SYNTAX        PwCepSdhVc4Ebm
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Equipped Bit Mask (EBM) for the second TUG-3 within the fractional VC-4 channel received from peer within the CEP extension header."

::= { pwCepFracEntry 19 }

pwCepFracSdhVc4PeerEbm3 OBJECT-TYPE

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SYNTAX        PwCepSdhVc4Ebm
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Equipped Bit Mask (EBM) for the third TUG-3 within the fractional VC-4 channel received from peer within the CEP extension header."

::= { pwCepFracEntry 20 }

pwCepFracRowStatus OBJECT-TYPE
SYNTAX        RowStatus
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"For creating, modifying, and deleting this row.

It is allowed to make changes to read-create entries in this table, but the operator should be aware that such changes for an active row may cause temporary mis-configurations between the peers in terms of the carried signal, leading to traffic disruption."

::= { pwCepFracEntry 21 }

pwCepFracStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
 "This variable indicates the storage type for this object."

 ::= { pwCepFracEntry 22 }

-- End Fractional CEP Configuration Table

-- CEP PW Performance Current Interval Table.
pwCepPerfCurrentTable OBJECT-TYPE
SYNTAX        SEQUENCE OF PwCepPerfCurrentEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
 "CEP bridges the SONET and packet worlds. In the packet
world, counts typically start from the time of service
creation - and don’t stop. In the SONET world, counts are
kept in 15 minute intervals. The PW CEP MIB supports both
methods. The current 15 minute interval counts are in
this table. The interval and total stats are in tables
following this.

This table provides per CEP PW performance information.
HC (high capacity) counters are required for some counts
due to the high speeds expected with CEP services. A SONET
path of width 48 (STS-48c) can rollover non-HC counters in
a few minutes."

 ::= { pwCepObjects 5 }

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

INDEX  { pwIndex }

 ::= { pwCepPerfCurrentTable 1 }

PwCepPerfCurrentEntry ::= SEQUENCE {
 pwCepPerfCurrentDbaInPacketsHC     HCPerfCurrentCount,
pwCepPerfCurrentDbaOutPacketsHC    HCPerfCurrentCount,
pwCepPerfCurrentInNegPtrAdjust     PerfCurrentCount,
pwCepPerfCurrentInPosPtrAdjust     PerfCurrentCount,
pwCepPerfCurrentInPtrAdjustSecs    PerfCurrentCount,
pwCepPerfCurrentOutNegPtrAdjust    PerfCurrentCount,
pwCepPerfCurrentOutPosPtrAdjust  PerfCurrentCount,
pwCepPerfCurrentOutPtrAdjustSecs  PerfCurrentCount,
pwCepPerfCurrentAbsPtrAdjust  Integer32,
pwCepPerfCurrentMissingPkts  PerfCurrentCount,
pwCepPerfCurrentPktsOoseq  PerfCurrentCount,
pwCepPerfCurrentPktsOoRngDropped  PerfCurrentCount,
pwCepPerfCurrentJtrBfrUnderruns  PerfCurrentCount,
pwCepPerfCurrentPktsMalformed  PerfCurrentCount,
pwCepPerfCurrentSummaryErrors  PerfCurrentCount,
pwCepPerfCurrentESs  PerfCurrentCount,
pwCepPerfCurrentSESs  PerfCurrentCount,
pwCepPerfCurrentUASs  PerfCurrentCount,
pwCepPerfCurrentFC  PerfCurrentCount

pwCepPerfCurrentDbaInPacketsHC OBJECT-TYPE
SYNTAX  HCPerfCurrentCount
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION  
"Number of DBA packets received."
::= { pwCepPerfCurrentEntry 1 }

pwCepPerfCurrentDbaOutPacketsHC OBJECT-TYPE
SYNTAX  HCPerfCurrentCount
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION  
"Number of DBA packets sent."
::= { pwCepPerfCurrentEntry 2 }

-- Pointer adjustment stats

pwCepPerfCurrentInNegPtrAdjust OBJECT-TYPE
SYNTAX  PerfCurrentCount
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION  
"Number of negative pointer adjustments sent on the
SONET path based on CEP pointer adjustments received."
::= { pwCepPerfCurrentEntry 3 }

pwCepPerfCurrentInPosPtrAdjust OBJECT-TYPE
SYNTAX  PerfCurrentCount
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION  
"Number of positive pointer adjustments sent on the
SONET path based on CEP pointer adjustments received."
::= { pwCepPerfCurrentEntry 4 }

pwCepPerfCurrentInPtrAdjustSecs OBJECT-TYPE
SYNTAX  PerfCurrentCount
MAX-ACCESS  read-only
pwCepPerfCurrentOutNegPtrAdjust OBJECT-TYPE
SYNTAX       PerfCurrentCount
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "Number of negative pointer adjustments seen on the SONET path and encoded onto sent CEP packets."
::= { pwCepPerfCurrentEntry 6 }

pwCepPerfCurrentOutPosPtrAdjust OBJECT-TYPE
SYNTAX       PerfCurrentCount
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "Number of positive pointer adjustments seen on the SONET path and encoded onto sent CEP packets."
::= { pwCepPerfCurrentEntry 7 }

pwCepPerfCurrentOutPtrAdjustSecs OBJECT-TYPE
SYNTAX       PerfCurrentCount
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "Number of seconds in which a positive or negative pointer adjustment was seen on the SONET path."
::= { pwCepPerfCurrentEntry 8 }

pwCepPerfCurrentAbsPtrAdjust OBJECT-TYPE
SYNTAX       Integer32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "Absolute Pointer adjustments is relative adjustment drifts between inbound and outbound streams. It is calculated as absolute value of:
 ( InPosPtrAdjust - InNegPtrAdjust ) -
 (OutPosPtrAdjust - OutNegPtrAdjust)   
::= { pwCepPerfCurrentEntry 9 }

pwCepPerfCurrentMissingPkts OBJECT-TYPE
SYNTAX       PerfCurrentCount
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "Number of missing packets (as detected via CEP header sequence number gaps)."
::= { pwCepPerfCurrentEntry 10 }

pwCepPerfCurrentPktsOoseq OBJECT-TYPE
SYNTAX       PerfCurrentCount
MAX-ACCESS   read-only
pwCepPerfCurrentPktsOoRngDropped OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of packets detected out of sequence (via CEP header sequence numbers), but successfully re-ordered. Note: some implementations may not support this feature (see pwCepCfgPktReorder)."
 ::= { pwCepPerfCurrentEntry 11 }

pwCepPerfCurrentJtrBfrUnderruns 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."
 ::= { pwCepPerfCurrentEntry 13 }

pwCepPerfCurrentPktsMalformed OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of packets detected with unexpected size, or bad headers stack."
 ::= { pwCepPerfCurrentEntry 14 }

pwCepPerfCurrentSummaryErrors OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "A summary of all the packet error types above (from missing packets to bad length packets)."
 ::= { pwCepPerfCurrentEntry 15 }

pwCepPerfCurrentESs OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "The counter associated with the number of Errored Seconds encountered."
 ::= { pwCepPerfCurrentEntry 16 }

pwCepPerfCurrentSESs OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
pwCepPerfCurrentUASs OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "The counter associated with the number of Unavailable Seconds encountered."
::= { pwCepPerfCurrentEntry 18 }

pwCepPerfCurrentFC OBJECT-TYPE
SYNTAX        PerfCurrentCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "CEP Failure Counts (FC-CEP). The number of CEP failure events. A failure event begins when the LOPS failure is declared, and 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."
::= { pwCepPerfCurrentEntry 19 }

-- End CEP PW Performance Current Interval Table

-- CEP PW Performance Interval Table.

pwCepPerfIntervalTable OBJECT-TYPE
SYNTAX        SEQUENCE OF PwCepPerfIntervalEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    "This table provides per CEP PW performance information much like the pwCepPerfCurrentTable 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. NOTE: Counter64 objects are used here, Counter32 is too small for OC-768 CEP PWs."
::= { pwCepObjects 6 }

pwCepPerfIntervalEntry OBJECT-TYPE
SYNTAX        PwCepPerfIntervalEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    "An entry in this table is created by the agent for every pwCepPerfCurrentEntry 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.
pwCepIndex is found in the pwCepCfg table.

INDEX { pwIndex, pwCepPerfIntervalNumber }

::= { pwCepPerfIntervalTable 1 }

PwCepPerfIntervalEntry ::= SEQUENCE {
  pwCepPerfIntervalNumber             Integer32,
  pwCepPerfIntervalValidData          TruthValue,
  pwCepPerfIntervalReset              INTEGER,
  pwCepPerfIntervalTimeElapsed        HCPerfTimeElapsed,
  pwCepPerfIntervalDbaInPacketsHC     HCPerfIntervalCount,
  pwCepPerfIntervalDbaOutPacketsHC    HCPerfIntervalCount,
  pwCepPerfIntervalInNegPtrAdjust     PerfIntervalCount,
  pwCepPerfIntervalInPosPtrAdjust     PerfIntervalCount,
  pwCepPerfIntervalInPtrAdjustSecs    PerfIntervalCount,
  pwCepPerfIntervalOutNegPtrAdjust    PerfIntervalCount,
  pwCepPerfIntervalOutPosPtrAdjust    PerfIntervalCount,
  pwCepPerfIntervalOutPtrAdjustSecs   PerfIntervalCount,
  pwCepPerfIntervalAbsPtrAdjust       Integer32,
  pwCepPerfIntervalMissingPkts        PerfIntervalCount,
  pwCepPerfIntervalPktsOoseq          PerfIntervalCount,
  pwCepPerfIntervalPktsOoRngDropped   PerfIntervalCount,
  pwCepPerfIntervalJtrBfrUnderruns    PerfIntervalCount,
  pwCepPerfIntervalPktsMalformed      PerfIntervalCount,
  pwCepPerfIntervalSummaryErrors      PerfIntervalCount,
  pwCepPerfIntervalESs                PerfIntervalCount,
  pwCepPerfIntervalSESs               PerfIntervalCount,
  pwCepPerfIntervalUASs               PerfIntervalCount,
  pwCepPerfIntervalFC                 PerfIntervalCount
}

pwCepPerfIntervalNumber OBJECT-TYPE
SYNTAX       Integer32 (1..96)
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
  "A number (normally between 1 and 96 to cover a 24 hour
   period) which 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."

::= { pwCepPerfIntervalEntry 1 }

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

pwCepPerfIntervalReset OBJECT-TYPE
SYNTAX INTEGER {
    reset (1),
    normal(2)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Used in cases where the user knows that the errors
within this interval should not be counted. Writing
'reset' sets all error counts to zero."
::= { pwCepPerfIntervalEntry 3 }

pwCepPerfIntervalTimeElapsed OBJECT-TYPE
SYNTAX HCPerfTimeElapsed
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."
::= { pwCepPerfIntervalEntry 4 }

pwCepPerfIntervalDbaInPacketsHC OBJECT-TYPE
SYNTAX HCPerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of DBA packets received."
::= { pwCepPerfIntervalEntry 5 }

pwCepPerfIntervalDbaOutPacketsHC OBJECT-TYPE
SYNTAX HCPerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of DBA packets sent."
::= { pwCepPerfIntervalEntry 6 }

-- Pointer adjustment stats
pwCepPerfIntervalInNegPtrAdjust OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of negative pointer adjustments sent on the
SONET path based on CEP pointer adjustments received."
::= { pwCepPerfIntervalEntry 7 }
pwCepPerfIntervalInPosPtrAdjust OBJECT-TYPE
SYNTAX        PerfIntervalCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of positive pointer adjustments sent on the
SONET path based on CEP pointer adjustments received."
::= { pwCepPerfIntervalEntry 8 }

pwCepPerfIntervalInPtrAdjustSecs OBJECT-TYPE
SYNTAX        PerfIntervalCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of seconds in which a pos or neg pointer
adjustment was sent on the SONET path."
::= { pwCepPerfIntervalEntry 9 }

pwCepPerfIntervalOutNegPtrAdjust OBJECT-TYPE
SYNTAX        PerfIntervalCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of negative pointer adjustments seen on the
SONET path and encoded onto sent CEP packets."
::= { pwCepPerfIntervalEntry 10 }

pwCepPerfIntervalOutPosPtrAdjust OBJECT-TYPE
SYNTAX        PerfIntervalCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of positive pointer adjustments seen on the
SONET path and encoded onto sent CEP packets."
::= { pwCepPerfIntervalEntry 11 }

pwCepPerfIntervalOutPtrAdjustSecs OBJECT-TYPE
SYNTAX        PerfIntervalCount
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of seconds in which a pos or neg pointer
adjustment was seen on the SONET path."
::= { pwCepPerfIntervalEntry 12 }

pwCepPerfIntervalAbsPtrAdjust OBJECT-TYPE
SYNTAX        Integer32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Absolute Pointer adjustments is relative adjustment
drifts between inbound and outbound streams. It is
calculated as absolute value of :
( InPosPtrAdjust  -   InNegPtrAdjust) -
(OutPosPtrAdjust  -  OutNegPtrAdjus t)     "
::= { pwCepPerfIntervalEntry 13 }
pwCepPerfIntervalMissingPkts OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of missing packets (as detected via CEP header sequence number gaps)."
::= { pwCepPerfIntervalEntry 14 }

pwCepPerfIntervalPktsOoseq OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets detected out of sequence (via CEP header sequence numbers), but successfully re-ordered. Note: some implementations may not support this feature (see pwCepCfgPktReorder)."
::= { pwCepPerfIntervalEntry 15 }

pwCepPerfIntervalPktsOoRngDropped OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets detected out of range (via CEP header sequence numbers), and could not be re-ordered, or could not fit in the jitter buffer."
::= { pwCepPerfIntervalEntry 16 }

pwCepPerfIntervalJtrBfrUnderruns 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."
::= { pwCepPerfIntervalEntry 17 }

pwCepPerfIntervalPktsMalformed OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets detected with unexpected size, or bad headers stack."
::= { pwCepPerfIntervalEntry 18 }

pwCepPerfIntervalSummaryErrors OBJECT-TYPE
SYNTAX PerfIntervalCount
MAX-ACCESS read-only
STATUS current
DESCRIPTION "A summary of all the packet error types above (from missing packets to bad length packets)."
::= { pwCepPerfIntervalEntry 19 }
pwCepPerfIntervalESs OBJECT-TYPE  
SYNTAX PerfIntervalCount  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The counter associated with the number of Errored Seconds encountered."  
::= { pwCepPerfIntervalEntry 20 }

pwCepPerfIntervalSESs OBJECT-TYPE  
SYNTAX PerfIntervalCount  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The counter associated with the number of Severely Errored Seconds encountered."  
::= { pwCepPerfIntervalEntry 21 }

pwCepPerfIntervalUASs OBJECT-TYPE  
SYNTAX PerfIntervalCount  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The counter associated with the number of Unavailable Seconds encountered."  
::= { pwCepPerfIntervalEntry 22 }

pwCepPerfIntervalFC OBJECT-TYPE  
SYNTAX PerfIntervalCount  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"CEP Failure Counts (FC-CEP). The number of CEP failure events. A failure event begins when the LOPS failure is declared, and 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."  
::= { pwCepPerfIntervalEntry 23 }

-- End CEP PW Performance Interval Table

-- CEP PW Total Performance Table

pwCepPerfTotalTable OBJECT-TYPE  
SYNTAX SEQUENCE OF PwCepPerfTotalEntry  
MAX-ACCESS not-accessible  
STATUS current  
DESCRIPTION  
"This table provides per CEP PW performance information much like the pwCepPerfIntervalTable above. However, these counts represent complete historical information."
NOTE: Counter64 objects are used here, Counter32 is too small for OC-768 CEP PWS.

::= { pwCepObjects 7 }

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

INDEX  { pwIndex }

::= { pwCepPerfTotalTable 1 }

PwCepPerfTotalEntry ::= SEQUENCE {
  pwCepPerfTotalDbaInPacketsHC         Counter64,
  pwCepPerfTotalDbaOutPacketsHC        Counter64,
  pwCepPerfTotalInNegPtrAdjust         Counter32,
  pwCepPerfTotalInPosPtrAdjust         Counter32,
  pwCepPerfTotalInPtrAdjustSecs        Counter32,
  pwCepPerfTotalOutNegPtrAdjust        Counter32,
  pwCepPerfTotalOutPosPtrAdjust        Counter32,
  pwCepPerfTotalOutPtrAdjustSecs       Counter32,
  pwCepPerfTotalAbsPtrAdjust           Integer32,
  pwCepPerfTotalMissingPkts            Counter32,
  pwCepPerfTotalPktsOoseq              Counter32,
  pwCepPerfTotalPktsOoRngDropped       Counter32,
  pwCepPerfTotalJtrBfrUnderruns        Counter32,
  pwCepPerfTotalPktsMalformed          Counter32,
  pwCepPerfTotalSummaryErrors          Counter32,
  pwCepPerfTotalESs                    Counter32,
  pwCepPerfTotalSESs                   Counter32,
  pwCepPerfTotalUASs                   Counter32,
  pwCepPerfTotalFC                     Counter32,
  pwCepPerfTotalDiscontinuityTime      TimeStamp
}

pwCepPerfTotalDbaInPacketsHC OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Number of DBA packets received."
::= { pwCepPerfTotalEntry 1 }

pwCepPerfTotalDbaOutPacketsHC OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
"Number of DBA packets sent."
 ::= { pwCepPerfTotalEntry 2 }

-- Pointer adjustment stats
pwCepPerfTotalInNegPtrAdjust OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of negative pointer adjustments sent on the
     SONET path based on CEP pointer adjustments received."
 ::= { pwCepPerfTotalEntry 3 }

pwCepPerfTotalInPosPtrAdjust OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of positive pointer adjustments sent on the
     SONET path based on CEP pointer adjustments received."
 ::= { pwCepPerfTotalEntry 4 }

pwCepPerfTotalInPtrAdjustSecs OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of seconds in which a positive or negative pointer
     adjustment was sent on the SONET path."
 ::= { pwCepPerfTotalEntry 5 }

pwCepPerfTotalOutNegPtrAdjust OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of negative pointer adjustments seen on the
     SONET path and encoded onto sent CEP packets."
 ::= { pwCepPerfTotalEntry 6 }

pwCepPerfTotalOutPosPtrAdjust OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of positive pointer adjustments seen on the
     SONET path and encoded onto sent CEP packets."
 ::= { pwCepPerfTotalEntry 7 }

pwCepPerfTotalOutPtrAdjustSecs OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Number of seconds in which a positive or negative pointer
     adjustment was seen on the SONET path."
pwCepPerfTotalAbsPtrAdjust OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Absolute Pointer adjustments is relative adjustment drifts between inbound and outbound streams. It is calculated as absolute value of:
( InPosPtrAdjust - InNegPtrAdjust) -
(OutPosPtrAdjust - OutNegPtrAdjust)"

pwCepPerfTotalMissingPkts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of missing packets (as detected via CEP header sequence number gaps)."

pwCepPerfTotalPktsOoseq OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets detected out of sequence (via CEP header sequence numbers), but successfully re-ordered. Note: some implementations may not support this feature (see pwCepCfgPktReorder)."

pwCepPerfTotalPktsOoRngDropped OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets detected out of range (via CEP header sequence numbers), and could not be re-ordered, or could not fit in the jitter buffer."

pwCepPerfTotalJtrBfrUnderruns 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."

pwCepPerfTotalPktsMalformed OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of packets detected with unexpected size, or bad headers stack."
::= { pwCepPerfTotalEntry 14 }

pwCepPerfTotalSummaryErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A summary of all the packet error types above (from missing packets to bad length packets)."
::= { pwCepPerfTotalEntry 15 }

pwCepPerfTotalESs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The counter associated with the number of Errored Seconds encountered."
::= { pwCepPerfTotalEntry 16 }

pwCepPerfTotalSESs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The counter associated with the number of Severely Errored Seconds. See pwCepCfgMissingPktsToSes."
::= { pwCepPerfTotalEntry 17 }

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

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

NOTE: Similar to RFC 3592, If the agent chooses to update the various performance statistics in real time then it must be prepared to retroactively reduce the ES, SES, counts (by the value of pwCepCfgSesToUas) and increase the UAS count (by that same value) when it determines that UAS state has been entered."
::= { pwCepPerfTotalEntry 18 }

pwCepPerfTotalFC OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"CEP Failure Counts (FC-CEP). The number of CEP failure events. A failure event begins when the LOPS failure is declared, and ends when the failure is cleared."

::= { pwCepPerfTotalEntry 19 }

pwCepPerfTotalDiscontinuityTime OBJECT-TYPE
SYNTAX      TimeStamp
MAX-ACCESS  read-only
STATUS      current

DESCRIPTION
"The value of sysUpTime on the most recent occasion at which any one or more of this segment’s Counter32 or Counter64 suffered a discontinuity. If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then this object contains a zero value."

::= { pwCepPerfTotalEntry 20 }

-- End of PW CEP Total Performance table

-- Conformance Configuration table

pwCepConformanceCfgTable OBJECT-TYPE
SYNTAX        SEQUENCE OF PwCepConformanceCfgEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"This table provides the means for the agent to declare whether certain CEP PW statistics objects are supported (conformed to) or not."

::= { pwCepObjects 9 }

PwCepConformanceCfgEntry OBJECT-TYPE
SYNTAX        PwCepConformanceCfgEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"The agent MUST create a single entry in this table."

INDEX  { pwCepConformanceCfgIndex }

::= { pwCepConformanceCfgTable 1 }

PwCepConformanceCfgEntry ::= SEQUENCE {
  pwCepConformanceCfgIndex            INTEGER,  
  pwCepPerfDbaInPacketsHCTruth        TruthValue,  
  pwCepPerfDbaInPacketsHCDesc        SnmpAdminString,  
  pwCepPerfDbaOutPacketsHCTruth       TruthValue,  
  pwCepPerfDbaOutPacketsHCDesc        SnmpAdminString,  
  pwCepPerfPktsOoseqTruth             TruthValue,  
  pwCepPerfPktsOoseqDesc              SnmpAdminString,  
}
pwCepPerfPktsOoRngDroppedTruth TruthValue,
pwCepPerfPktsOoRngDroppedDesc SnmpAdminString,
pwCepPerfSummaryErrorsTruth TruthValue,
pwCepPerfSummaryErrorsDesc SnmpAdminString
}

pwCepConformanceCfgIndex OBJECT-TYPE
SYNTAX INTEGER (0..128)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Any arbitrary number."
::= { pwCepConformanceCfgEntry 1 }

pwCepPerfDbaInPacketsHCTruth OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Tells whether the pwCepPerf...DbaInPacketsHC
in the pwCepPerf...Table is supported."
::= { pwCepConformanceCfgEntry 2 }

pwCepPerfDbaInPacketsHCDesc OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Explanation for pwCepPerf...DbaInPacketsHC
support in the pwCepPerf...Table."
::= { pwCepConformanceCfgEntry 3 }

pwCepPerfDbaOutPacketsHCTruth OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Tells whether the pwCepPerf...DbaOutPacketsHC
in the pwCepPerf...Table is supported."
::= { pwCepConformanceCfgEntry 4 }

pwCepPerfDbaOutPacketsHCDesc OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Explanation for pwCepPerf...DbaOutPacketsHC
support in the pwCepPerf...Table."
::= { pwCepConformanceCfgEntry 5 }

pwCepPerfPktsOoSeqTruth OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Tells whether the pwCepPerf...PktsOoseq in the pwCepPerf...Table is supported."
::= { pwCepConformanceCfgEntry 6 }

pwCepPerfPktsOoseqDesc OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Explanation for pwCepPerf...PktsOoseq support in the pwCepPerf...Table."
::= { pwCepConformanceCfgEntry 7 }

pwCepPerfPktsOoRngDroppedTruth OBJECT-TYPE
SYNTAX        TruthValue
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Tells whether the pwCepPerf...PktsOoRngDropped in the pwCepPerf...Table is supported."
::= { pwCepConformanceCfgEntry 8 }

pwCepPerfPktsOoRngDroppedDesc OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Explanation for pwCepPerf...PktsOoRngDropped support in the pwCepPerf...Table."
::= { pwCepConformanceCfgEntry 9 }

pwCepPerfSummaryErrorsTruth OBJECT-TYPE
SYNTAX        TruthValue
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Tells whether the pwCepPerf...SummaryError in the pwCepPerf...Table is supported."
::= { pwCepConformanceCfgEntry 10 }

pwCepPerfSummaryErrorsDesc OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Explanation for pwCepPerf...SummaryError support in the pwCepPerf...Table."
::= { pwCepConformanceCfgEntry 11 }

-- End of CEP PW Conformance report table

-- Conformance Information

pwCepGroups OBJECT IDENTIFIER ::= { pwCepConformance 1 }
pwCepCompliances OBJECT IDENTIFIER ::= { pwCepConformance 2 }

-- Compliance statement for full compliant implementations

pwCepModuleFullCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The compliance statement for agent that support full
              CEP PW configuration through this MIB module."

MODULE -- this module
  MANDATORY-GROUPS { pwCepGroup,
                        pwCepCfgGroup,
                        pwCepPerfCurrentGroup,
                        pwCepPerfIntervalGroup,
                        pwCepPerfTotalGroup,
                        pwCepConformanceCfgGroup }

GROUP pwPwCepFractionalGroup
   DESCRIPTION "This group is only mandatory for implementations
                 that support fractional SPE."

GROUP pwPwCepFractionalSts1Vc3Group
   DESCRIPTION "This group is only mandatory for implementations
                 that support the fractional STS-1/VC-3."

GROUP pwPwCepFractionalVc4Group
   DESCRIPTION "This group is only mandatory for implementations
                 that support the Fractional VC-4."

GROUP pwPwCepSignalingGroup
   DESCRIPTION "This group is only mandatory for implementations
                 that support the CEP PW signaling."

OBJECT pwCepType
   SYNTAX INTEGER { spe(1) }
   MIN-ACCESS read-only
   DESCRIPTION "The support of the value vt(2) or fracSpe(3) is
               optional. If either of these options are supported,
               read-write access is not required."

OBJECT pwCepSonetPayloadLength
   MIN-ACCESS read-only
   DESCRIPTION "Write access is not required for implementations
               that support only the default values (which are
               based on the pwCepType)."

OBJECT pwCepCfgMinPktLength
   MIN-ACCESS read-only
   DESCRIPTION "Write access is not required for implementations
               that support only a single pre-defined value."
OBJECT pwCepCfgEnableDBA
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgRtpHdrSuppress
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that do not support RTP header for CEP connections."

OBJECT pwCepCfgConsecPktsInsync
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgConsecMissingOutSync
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgPktErrorPlayOutValue
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgMissingPktsToSes
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgSesToUas
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgSecsToExitUas
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepCfgRowStatus
SYNTAX RowStatus { active(1), notInService(2), notReady(3) }
WRITE-SYNTAX RowStatus { active(1), notInService(2), createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait is not required."

OBJECT pwCepFracMode
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

OBJECT pwCepFracAsync
SYNTAX PwCepFracAsyncMap { other(0) }
MIN-ACCESS read-only
Support for ds3(1) or e3(2) and read-write access is not required if the implementation do not support these options.

DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."

DESCRIPTION "Write access is not required for implementations where the EBM is derived from configuration in other MIB modules."

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DESCRIPTION "Write access is not required for implementations that support only a single pre-defined value."
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations where the EBM is derived from configuration in other MIB modules."

OBJECT pwCepFracSdhVc4Ebm3
MIN-ACCESS read-only
DESCRIPTION "Write access is not required for implementations where the EBM is derived from configuration in other MIB modules."

OBJECT pwCepFracRowStatus
SYNTAX RowStatus { active(1), notInService(2), notReady(3) }
WRITE-SYNTAX RowStatus { active(1), notInService(2), createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait is not required."

::= { pwCepCompliances 1 }

-- Compliance requirement for read only compliant implementations.

pwModuleReadOnlyCompliance MODULE-COMPLIANCE

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STATUS current
DESCRIPTION "The compliance statement for agents that provide read only support for PW CEP MIB Module. Such devices can then be monitored but cannot be configured using this MIB module."

MODULE -- this module
MANDATORY-GROUPS { pwCepGroup,
  pwCepCfgGroup,
  pwCepPerfCurrentGroup,
  pwCepPerfIntervalGroup,
  pwCepPerfTotalGroup,
  pwCepConformanceCfgGroup
  }

GROUP pwPwCepFractionalGroup
DESCRIPTION "This group is only mandatory for implementations that support fractional SPE."

GROUP pwPwCepFractionalSts1Vc3Group
DESCRIPTION "This group is only mandatory for implementations that support the fractional STS-1/VC-3."

GROUP pwPwCepFractionalVc4Group
DESCRIPTION "This group is only mandatory for implementations that support the Fractional VC-4."

GROUP pwPwCepSignalingGroup
DESCRIPTION "This group is only mandatory for implementations that support the CEP PW signaling."

OBJECT pwCepType
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepSonetIfIndex
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgIndex
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepSonetPayloadLength
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgMinPktLength
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgEnableDBA
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgRtpHdrSuppress
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgJtrBfrDepth
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgConsecPktsInsync
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgConsecMissingOutSync
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgPktErrorPlayOutValue
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgMissingPktsToSes
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgSesToUas
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgSecsToExitUas
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgRowStatus
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepCfgStorageType
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracMode
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracAsync
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracVtgMap
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracEbm
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Mode
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tu3Map1
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tu3Map2
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tu3Map3
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tug2Map1
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tug2Map2
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Tug2Map3
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT pwCepFracSdhVc4Ebm1
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT           pwCepFracSdhVc4Ebm2
MIN-ACCESS       read-only
DESCRIPTION "Write access is not required."

OBJECT           pwCepFracSdhVc4Ebm3
MIN-ACCESS       read-only
DESCRIPTION "Write access is not required."

OBJECT           pwCepFracRowStatus
MIN-ACCESS       read-only
DESCRIPTION "Write access is not required."

OBJECT           pwCepFracStorageType
MIN-ACCESS       read-only

::= { pwCepCompliances 2 }

-- Units of conformance.

pwCepGroup OBJECT-GROUP
OBJECTS {
    pwCepType,
    pwCepSonetIfIndex,
    pwCepSonetConfigErrorOrStatus,
    pwCepCfgIndex,
    pwCepTimeElapsed,
    pwCepValidIntervals,
    pwCepCurrentIndications,
    pwCepLatchedIndications,
    pwCepLastEsTimeStamp
}
STATUS  current
DESCRIPTION
"Collection of objects for basic CEP PW config and status."
::= { pwCepGroups 1 }

pwPwCepSignalingGroup OBJECT-GROUP
OBJECTS {
    pwCepPeerCepOption
}
STATUS  current
DESCRIPTION
"Collection of objects required if the network element support CEP connections signaling."
::= { pwCepGroups 2 }

pwCepCfgGroup OBJECT-GROUP
OBJECTS {
    pwCepCfgIndexNext,
    pwCepConfigError,
    pwCepSonetPayloadLength,
pwCepCfgMinPktLength,
pwCepCfgPktReorder,
pwCepCfgEnableDBA,
pwCepCfgRtpHdrSuppress,
pwCepCfgJtrBfrDepth,
pwCepCfgConsecPktsInsync,
pwCepCfgConsecMissingOutSync,
pwCepCfgPktErrorPlayOutValue,

pwCepCfgMissingPktsToSes,
pwCepCfgSesToUas,
pwCepCfgSecsToExitUas,

pwCepCfgRowStatus,
pwCepCfgStorageType
}

STATUS  current
DESCRIPTION
"Collection of detailed objects needed to
configure CEP PWs."
::= { pwCepGroups 3 }

pwCepPerfCurrentGroup OBJECT-GROUP
OBJECTS {

pwCepPerfCurrentDbaInPacketsHC,
pwCepPerfCurrentDbaOutPacketsHC,

pwCepPerfCurrentInNegPtrAdjust,
pwCepPerfCurrentInPosPtrAdjust,
pwCepPerfCurrentInPtrAdjustSecs,
pwCepPerfCurrentOutNegPtrAdjust,
pwCepPerfCurrentOutPosPtrAdjust,
pwCepPerfCurrentOutPtrAdjustSecs,
pwCepPerfCurrentAbsPtrAdjust,

pwCepPerfCurrentMissingPkts,
pwCepPerfCurrentPktsOoseq,
pwCepPerfCurrentPktsOoRngDropped,
pwCepPerfCurrentJtrBfrUnderruns,
pwCepPerfCurrentPktsMalformed,
pwCepPerfCurrentSummaryErrors,

pwCepPerfCurrentESs,
pwCepPerfCurrentSESs,
pwCepPerfCurrentUASs,
pwCepPerfCurrentFC
}

STATUS  current
DESCRIPTION
"Collection of statistics objects for CEP PWs."
::= { pwCepGroups 4 }
pwCepPerfIntervalGroup OBJECT-GROUP
   OBJECTS {
      pwCepPerfIntervalValidData,
      pwCepPerfIntervalReset,
      pwCepPerfIntervalTimeElapsed,
      pwCepPerfIntervalDbaInPacketsHC,
      pwCepPerfIntervalDbaOutPacketsHC,
      pwCepPerfIntervalInNegPtrAdjust,
      pwCepPerfIntervalInPosPtrAdjust,
      pwCepPerfIntervalInPtrAdjustSecs,
      pwCepPerfIntervalOutNegPtrAdjust,
      pwCepPerfIntervalOutPosPtrAdjust,
      pwCepPerfIntervalOutPtrAdjustSecs,
      pwCepPerfIntervalAbsPtrAdjust,
      pwCepPerfIntervalMissingPkts,
      pwCepPerfIntervalPktsOoseq,
      pwCepPerfIntervalPktsOoRngDropped,
      pwCepPerfIntervalJtrBfrUnderruns,
      pwCepPerfIntervalPktsMalformed,
      pwCepPerfIntervalSummaryErrors,
      pwCepPerfIntervalESs,
      pwCepPerfIntervalSESs,
      pwCepPerfIntervalUASs,
      pwCepPerfIntervalFC
   }

DESCRIPTION
   "Collection of statistics objects for CEP PWs."
   ::= { pwCepGroups 5 }

pwCepPerfTotalGroup OBJECT-GROUP
   OBJECTS {
      pwCepPerfTotalDbaInPacketsHC,
      pwCepPerfTotalDbaOutPacketsHC,
      pwCepPerfTotalInNegPtrAdjust,
      pwCepPerfTotalInPosPtrAdjust,
      pwCepPerfTotalInPtrAdjustSecs,
      pwCepPerfTotalOutNegPtrAdjust,
      pwCepPerfTotalOutPosPtrAdjust,
      pwCepPerfTotalOutPtrAdjustSecs,
      pwCepPerfTotalAbsPtrAdjust,
      pwCepPerfTotalMissingPkts,
      pwCepPerfTotalPktsOoseq,
      pwCepPerfTotalPktsOoRngDropped,
      pwCepPerfTotalJtrBfrUnderruns,
      pwCepPerfTotalPktsMalformed,
      pwCepPerfTotalSummaryErrors,
pwCepPerfTotalESs,
pwCepPerfTotalSESs,
pwCepPerfTotalUASs,
pwCepPerfTotalFC,
pwCepPerfTotalDiscontinuityTime

{ pwCepGroups 6 }

STATUS current

DESCRIPTION
"Collection of statistics objects for CEP PWS."
::= { pwCepGroups 6 }

pwPwCepFractionalGroup OBJECT-GROUP
OBJECTS {
  pwCepFracRowStatus,
pwCepFracStorageType
}

STATUS current

DESCRIPTION
"Collection of fractional SPE objects. These objects are optional and should be supported only if fractional SPE is supported within the network element."
::= { pwCepGroups 7 }

pwPwCepFractionalSts1Vc3Group OBJECT-GROUP
OBJECTS {
  pwCepFracMode,
pwCepFracConfigError,
pwCepFracAsync,
pwCepFracVtgMap,
pwCepFracEbm,
pwCepFracPeerEbm
}

STATUS current

DESCRIPTION
"Collection of fractional STS-1/VC3 objects. These objects are optional and should be supported only if fractional STS-1/VC3 is supported within the network element."
::= { pwCepGroups 8 }

pwPwCepFractionalVc4Group OBJECT-GROUP
OBJECTS {
  pwCepFracSdhVc4Mode,
pwCepFracSdhVc4Tu3Map1,
pwCepFracSdhVc4Tu3Map2,
pwCepFracSdhVc4Tu3Map3,
pwCepFracSdhVc4Tug2Map1,
pwCepFracSdhVc4Tug2Map2,
pwCepFracSdhVc4Tug2Map3,
pwCepFracSdhVc4Ebm1,
pwCepFracSdhVc4Ebm2,
pwCepFracSdhVc4Ebm3,
pwCepFracSdhVc4PeerEbm1,
pwCepFracSdhVc4PeerEbm2,
pwCepFracSdhVc4PeerEbm3
7 Security considerations

It is clear that this MIB module is potentially useful for monitoring of CEP 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 pwCepTable, pwCepCfgTable and pwCepFracTable contains objects to CEP 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 v3 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 pwCepTable, pwCepPerfCurrentTable, pwCepPerfIntervalTable and pwCepPerfTotalTable collectively show the CEP pseudo wire 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.

8 References

1.3 Normative references


1.4 Informative references

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13 IANA considerations

PWE3 related standards track PW modules should be rooted under the pwMIB subtree. The IANA is requested to manage that namespace. New assignments can only be made via a Standards Action as specified in [RFC2434].

IANA is requested to make a MIB OID assignment under the pwMIB branch as specified in section 12.1.

12.1 IANA Considerations for PW-CEP-STD-MIB

This document also requests IANA to assign { pwMIB 5 } to the PW-CEP-STD-MIB module specified in this document.

14 Acknowledgement

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