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Telekomunikacijsko upravljalno omrežje (TMN) - Informacijski model pleziohrone digitalne hierarhije (PDH), gledano s strani omrežnega elementa (NE)

Telecommunications Management Network (TMN); Plesiochronous Digital Hierarchy (PDH) information model for the Network Element (NE) view;

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Telecommunications Management Network (TMN).

The present document describes the information model for Network Elements (NEs), which use the Plesiochronous Digital Hierarchy (PDH) multiplexing structure.

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Date of adoption of this EN:	23 February 2001
Date of latest announcement of this EN (doa):	31 May 2001
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Introduction

Network Operators have extensive deployments of PDH and SDH equipments in their Networks. Some are flexible and/or monitorable and do possess a standard management interface. A suitable PDH information model is required for such equipment to take advantage of the management capability provided by functional standards related to PDH interfaces of those equipments and enable it to be part of an overall managed network.

The model presented in the present document represents 4 major functional requirements:

1) Fixed PDH structures.

2) Flexible PDH structures.

3) SDH Transport over PDH bearers.

4) The monitoring of PDH Ports.

Fixed PDH Structures utilize the inheritance tree given in figure 1 and the naming tree in figure 3. As can be seen this can be used to model the rigid multiplexing structure from 64 kbits/sec to 140 Mbits/sec interfaces in line systems. An example is given in figure 7 of a 140 Mbit/s line signal multiplexed through the 34 Mbit/s and 8 Mbit/s levels to a 2 Mbit/s tributary signal which is mapped in a VC12 by a transmission system.

Flexible PDH structures use the same inheritance structure but the naming tree as in figure 2. This represents the flexible structures that may be encountered in PDH crossconnects with ports at all data rates. An example is given in figure 6.

The transport of SDH (VC12) and ATM traffic is represented by the Objects e3INTTTP and e4INTTTP for 34 Mbits/sec bearers and 140 Mbits/sec bearers respectively.

The reporting control of failures of PDH signals at the different path layers is modelled by reusing techniques specified in ITU-T Recommendation M.3100 [3] (flexible assignment of severities to a failure).

The monitoring of the PDH ports is represented by the portMode Package that defines the behaviour. This package models a port that may be enabled for monitoring or may be disabled for monitoring. In addition the port may be set for auto monitoring providing no valid signal is present on the port. The port is then automatically enabled for monitoring when a valid signal is applied for the first time.

It should also be noted that the behaviour of the operationalState is as defined by the ETSI community (different from the SDH environment) and this only applies to this PDH model. This is apparent from the notes that remain in the document. Only equipment failures, and not transmission failures, affect the attribute value.

1 Scope

The present document defines the information model to be used at the interface between Network Elements (NEs) and management systems, for the management of equipment which use the Plesiochronous Digital Hierarchy (PDH).

The present document defines:

- the information model for network elements using PDH multiplexing, including PDH interfaces of Synchronous Digital Hierarchy (SDH) network elements.

The present document does not define:

- the protocol stack to be used for message communication;
- the network level management processes;
- the application contexts;
- the conformance requirements to be met by an implementation of this information model;
- information models for other systems or equipment.

The information model defined in the present document (and the corresponding message set) is concerned with the management of NEs, the equipment by which they are implemented and the functions contained within them. More precisely, it applies to an equipment domain visible at the element manager to element interface and is only concerned with information available within that domain. Information proper to the domain of a network level management process is not included within this model.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI ETS 300 337 (Edition 1): "Transmission and Multiplexing (TM); Generic frame structures for the transport of various signals (including Asynchronous Transfer Mode (ATM) cells and Synchronous Digital Hierarchy (SDH) elements) at the ITU-T Recommendation G.702 hierarchical rates of 2 048 kbit/s, 34 368 kbit/s and 139 264 kbit/s".

[2] ITU-T Recommendation G.702 (1988): "Digital hierarchy bit rates".

[3] ITU-T Recommendation M.3100 (1995): "Generic network information model".

[4] ITU-T Recommendation X.721 (1992): "Information technology - Open Systems Interconnection - Structure of management information: definition of management information".

[5] ITU-T Recommendation G.704 (1995): "Synchronous frame structures used at 1 544 kbit/s, 6 312 kbit/s, 2 048 kbit/s, 8 488 kbit/s and 44 736 kbit/s hierarchical levels".

[6] ITU-T Recommendation G.706 (1991): "Frame alignment and Cyclic Redundancy Check (CRC) procedures relating to basic frame structures defined in Recommendation G.704".

[7] ETSI ETS 300 167: "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces".

[8] ETSI ETS 300 417-5-1 (1998): "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 5-1: Plesiochronous Digital Hierarchy (PDH) path layer functions".

[9] ETSI ETS 300 417-1-1 (1996): "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 1-1: Generic processes and performance".

[10] ETSI ETS 300 417-2-1 (1997): "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 2-1: Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply.

AIS	Alarm Indication Signal
ASN.1	Abstract Syntax Notation No. 1
ATM	Asynchronous Transfer Mode
CTP	Connection Termination Point
EBER	Excessive Bit Error Ratio
FERF	Far End Receive Failure
LOF	Loss Of Frame
LOS	Loss Of Signal
NE	Network Element
PDH	Plesiochronous Digital Hierarchy
Pkg	Package
PPA	Plesiochronous Physical Adaptation
PPI	Plesiochronous Physical Interface
PPT	Plesiochronous Physical Termination
RDN	Relative Distinguished Name
SDH	Synchronous Digital Hierarchy
TMN	Telecommunications Management Network
TP	Termination Point
TTP	Trail Termination Point
VC-n	Virtual Container n

4 Registration supporting Abstract Syntax Notation No. 1 (ASN.1) for EN 300 371

```
ASN1TypeModule {ccitt(0) identified-organization(4) etsi(0) ets371(371) informationModel(0)
asn1Module(2) asn1TypeModule(0)}
DEFINITIONS IMPLICIT TAGS ::= BEGIN
-- EXPORT Everything
en371 OBJECT IDENTIFIER ::= {ccitt(0) identified-organization(4) etsi(0) ets371(371)
informationModel(0)}
en371ObjectClass OBJECT IDENTIFIER ::= {en371 managedObjectClass(3)}
en371Package OBJECT IDENTIFIER ::= {en371 package(4)}
en371NameBinding OBJECT IDENTIFIER ::= {en371 nameBinding(6)}
en371Attribute OBJECT IDENTIFIER ::= {en371 attribute(7)}
en371Action OBJECT IDENTIFIER ::= {en371 action(9)}
en371Notification OBJECT IDENTIFIER ::= {en371 notification(10)}
END
```

5 PDH fragment

This clause provides managed objects required to model PDH interfaces.

In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document. The IMPORT clause does not include uninstantiated super classes.

```
BEGIN
IMPORTS
alarmSeverityAssignmentProfile
FROM ASN1DefinedTypesModule {itu(0) recommendation(0) m(13) gnm(3100) informationModel(0)
                    managedObjectClass (3)};
END
```

5.1 Object classes definitions

5.1.1 Electrical PDH physical interface

This clause describes the object classes required to model the PDH physical interface.

NOTE 1: Whether these require attributes to model more features (e.g. PDH level, line code, etc.) are for further study.

```
pPITTPBidirectionalR1    MANAGED OBJECT CLASS
DERIVED FROM "Recommendation M.3100: 1995":trailTerminationPointBidirectional,
                      pPITTPSinkR1,
                      pPITTPSource;
REGISTERED AS {en371ObjectClass 100};


pPITTPSinkR1        MANAGED OBJECT CLASS
DERIVED FROM    "Recommendation M.3100: 1995":trailTerminationPointSink;
CHARACTERIZED BY
    "Recommendation X.721: 1992":administrativeStatePackage,
    "Recommendation M.3100: 1995":createDeleteNotificationsPackage,
    "Recommendation M.3100: 1995":stateChangeNotificationPackage,
    "Recommendation M.3100: 1995":tmnCommunicationsAlarmInformationPackage,
    "Recommendation M.3100: 1995":userLabelPackage,
    "Recommendation M.3100: 1995":alarmSeverityAssignmentPointerPackage,
    pPITTPSinkR1Pkg PACKAGE
        BEHAVIOUR
        alarmReportingControlBehaviour,
        pPITTPSinkR1BehaviourPkg BEHAVIOUR

DEFINED AS

"This managed object class represents the point where the incoming interface signal is converted
into an internal logic level and the timing is recovered from the line signal. The upStream
connectivity pointer is NULL for an instance of this class.

A communicationsAlarm notification shall be issued if a Loss of Signal (LOS) is detected. The
probableCause parameter of the notification shall indicate lossOfSignal [3].

The operational state is disabled if a failure of the equipment affecting an instance of this class
prevents the resource from operation";

        ATTRIBUTES
        pPITTPId            GET;;;
    CONDITIONAL PACKAGES
        tpSpecificPersistanceTimePkg    PRESENT IF

"the persistancy time for raising / clearing alarms can be set specifically for an instance of this
class thus superseding the values which are in effect for all termination points of a NE",

        portModePkg                         PRESENT IF

"an instance supports it"

    ;
```

```
REGISTERED AS {en371ObjectClass 101};
pPITTPSource        MANAGED OBJECT CLASS
DERIVED FROM    "Recommendation M.3100: 1995":trailTerminationPointSource;
CHARACTERIZED BY
    "Recommendation M.3100: 1995":createDeleteNotificationsPackage,
    "Recommendation M.3100: 1995":userLabelPackage,
    pPITTPSourcePkg PACKAGE
    BEHAVIOUR
    pPITTPSourceBehaviourPkg BEHAVIOUR

DEFINED AS

"This managed object class represents the point where the internal logic level and the timing is
converted into a line signal.

The operational state is disabled if a failure of the equipment affecting an instance of this class
prevents the resource from operation.

The downStream connectivity pointer is NULL for an instance of this class.";;

    ATTRIBUTES
    pPITTPId            GET;;;

REGISTERED AS { en371ObjectClass 3 };
```

NOTE 2: As for the attribute operationalState the decision has been taken in the ETSI/TM2 Meeting Dublin (Oct.97) that no transmission failures but equipment failures will impact the value of that attribute. This behaviour is applicable in general for the PDH TP fragment. No re-registration is considered to be necessary in the pPITTPSource class definition.

5.1.2 European PDH Alarm Indication Signal (AIS) trail termination point

This generic object class represents a particular case of termination point used in a managed element where no connectivity at respective level is provided. Instances of this object class are used when, in one layer, no flexibility is provided, but a direct adaptation to client is present.

The sink object class includes the AIS and LOF monitoring function of a respective Connection Termination Point (CTP) which is not instantiated where no connectivity on the respective level is provided.

Object classes inherited from this class are labelled according to the European PDH hierarchy (exATTP, where x = 0 stands for 64 kbit/s, x = 1 for 2 Mbit/s, x = 2 for 8 Mbit/s, x = 3 for 34 Mbit/s and x = 4 for 140 Mbit/s.)

NOTE: The possibility of adding conditional packages (present if the equipment supports the features) in order to model the capability to reveal Excessive Bit Error Ratio (EBER) is for further study.

The subclasses represent two types of combined functions:

1) En/Pne_A [10] and Pne_TT [8]
   The function En/Pne_A is the adaptation from physical section layer to the client PDH path layer (Pne) and the function Pne_TT terminates the trail in that path layer.

2) Pme/Pne_A and Pne_TT [8]
   The function Pme/Pne_A adapts from the server PDH path layer (Pme) to a framed, client PDH path layer (Pne) characteristic information (P31e_CI, P22e_CI, P12s_CI). The function Pne_TT terminates the trail in that path layers.

In both cases the management information exchanged with the combined functions is identical. As a consequence one object exATTP reflects the management view for the particular PDH path (x=1,2,3,4). Using the objects exATTP a PDH interface can be represented by a fewer number of instances than is obtained if objects are used which do not represent combined functions. These alternative representations are shown in figure 5 and figure 4, respectively.

```
ePDHATTPBidirectionalR1  MANAGED OBJECT CLASS
DERIVED FROM
    ePDHTTPBidirectionalR1,
    ePDHATTPSinkR1,
    ePDHATTPSource;
```

```
REGISTERED AS {en371ObjectClass 102 };
ePDHATTPSinkR1              MANAGED OBJECT CLASS
DERIVED FROM                ePDHTTPSinkR1;
CHARACTERIZED BY
ePDHATTPSinkR1Pkg           PACKAGE
BEHAVIOUR
ePDHATTPSinkR1Behaviour     BEHAVIOUR

DEFINED AS

"This object class includes the AIS and LOF monitoring function of a respective CTP which is not
instantiated where no connectivity on the respective level is provided.

A communicationsAlarm notification shall be issued if an AIS is detected. The probableCause
parameter of the notification shall indicate aIS.

A communicationsAlarm notification shall be issued if a LOF is detected. The probableCause parameter
of the notification shall indicate lossOfFrame.

An instance of this object class is used when, in one layer, no flexibility is provided, but a
direct adaptation to client is present.

The upStream connectivity pointer attribute value of an instance of this object class is equal to
NULL";;;;

REGISTERED AS {en371ObjectClass 103 };


ePDHATTPSource      MANAGED OBJECT CLASS
DERIVED FROM        ePDHTTPSource;
CHARACTERIZED BY
ePDHTPSourcePkg PACKAGE
BEHAVIOUR
ePDHATTPSourceBehaviourPkg BEHAVIOUR

DEFINED AS

"The downStream connectivity pointer attribute value of an instance of this object class is equal to
NULL.";;;;

REGISTERED AS {en371ObjectClass 5};
```


5.1.3 European PDH connection termination point

This clause describes an object class (sink, source or bi-directional) which represents the model for a generic PDH connection termination point (2, 8, 34 and 140 Mbit/s).

Object classes inherited from this class are labelled according to the European PDH hierarchy (exCTP, where x = 0 stands for 64 kbit/s, x = 1 for 2 Mbit/s, x = 2 for 8 Mbit/s, x = 3 for 34 Mbit/s and x = 4 for 140 Mbit/s).

The subclasses represent two types of adaptation functions:

1) En/Pne_A or En/Pnx_A [10]
   The function En/Pne_A adapts from physical section layer (En) to a framed PDH path layer characteristic information (P4e_CI, P31e_CI, P22e_CI, P12s_CI).
   The function En/Pnx_A adapts from physical section layer (En) to an unframed PDH path layer characteristic information (Pnx_CI), which is a signal of non-specified content [10].

2) Pme/Pne_A or Pme/Pnx_A [8]
   The function Pme/Pne_A adapts from the server PDH path layer (Pme) to a framed, client PDH path layer (Pne) characteristic information (P31e_CI, P22e_CI, P12s_CI). The function Pme/Pnx_A adapts from the server PDH path layer (Pme) to an unframed PDH path layer characteristic information (Pnx_CI), which is a signal of non-specified content [8].

```
ePDHCTPSinkR1       MANAGED OBJECT CLASS
DERIVED FROM        "Recommendation M.3100: 1995":connectionTerminationPointSink;
CHARACTERIZED BY
"Recommendation M.3100: 1995":createDeleteNotificationsPackage,
"Recommendation M.3100: 1995":operationalStatePackage,
"Recommendation M.3100: 1995":stateChangeNotificationPackage,
"Recommendation M.3100: 1995":tmnCommunicationsAlarmInformationPackage,
"Recommendation M.3100: 1995":alarmSeverityAssignmentPointerPackage,
ePDHCTPSinkR1Pkg PACKAGE
```

```
        BEHAVIOUR
        alarmReportingControlBehaviour,
        ePDHCTPSinkR1Behaviour  BEHAVIOUR

DEFINED AS

"This object class represents the termination of a PDH connection and models the adaptation sink
function in different PDH path layers represented by subclasses of this class.

An instance of this object class shall be used when, in one layer, flexibility is available or when
there is no termination of a client characteristic information (Pnx-CI).

The attribute framedSignalMode may have the values 'active' and 'inactive'. An attributeValueChange
notification is issued when the value is modified and the inherited conditional package
attributeValueChangeNotificationPackage is instantiated.

If the value is set 'active', then the adaptation processing of a framed signal is provisioned and
the detection of the defects LOF and AIS is enabled. A communicationsAlarm notification shall be
issued if an AIS is detected. The probableCause parameter of the notification shall indicate aIS
[3]. A communicationsAlarm notification shall be issued if an LOF is detected. The probableCause
parameter of the notification shall indicate lossOfFrame [3]. In case of defect detection the
consequent action aSSF (all-ONES) is performed.

If the value is set 'inactive', then this adaptation function is deactivated assuming the reception
of an unframed signal (characteristic information Pnx_CI).

An attributeValueChange notification is issued when the value of the attribute frameStatus is
changed and the inherited conditional package attributeValueChangeNotificationPackage is
instantiated.

The operational state is disabled if a failure of the equipment affecting an instance of this class
prevents the resource from operation.";;

    ATTRIBUTES
ePDHCTPId               GET,
framedSignalMode    GET-REPLACE,
frameStatus         GET;
;;
    CONDITIONAL PACKAGES
tpSpecificPersistanceTimePkg    PRESENT IF

"the persistency time for raising / clearing alarms can be set specifically for an instance of this
class thus superseding the values which are in effect for all termination points of a NE";

REGISTERED AS {en371ObjectClass 104 };


ePDHCTPSource   MANAGED OBJECT CLASS
DERIVED FROM    "Recommendation M.3100: 1995":connectionTerminationPointSource;
CHARACTERIZED BY
"Recommendation M.3100: 1995":createDeleteNotificationsPackage,
ePDHCTPSourcePkg    PACKAGE
BEHAVIOUR
ePDHCTPSourceBehaviourPkg BEHAVIOUR

DEFINED AS

"This object class originates a PDH hierarchy connection.

The operational state is disabled if a failure of the equipment affecting an instance of this class
prevents the resource from operation.";;

    ATTRIBUTES
ePDHCTPId       GET;;;

REGISTERED AS {en371ObjectClass 8};
```


NOTE 1: As for the attribute operationalState, no transmission failures but equipment failures will impact the value of that attribute. This behaviour is applicable in general for the PDH TP fragment. No re-registration is considered to be necessary in the ePDHCTPSource class definition.

NOTE 2: The superclass ePDHCTPBidirectionalR1 (not instantiated) needs not to be defined since the instantiable bidirectional subclasses e*CTPBidirectionalR1 should inherit from ePDHCTPSinkR1 and / Source only. Note that the superclass CTPBidirectional inherits from cTPSink / Source without special properties added.