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Telecommunications Management Network (TMN); Asynchronous Transfer Mode (ATM) management information model for the X interface between Operation Systems (OSs) of a Virtual Path (VP)/Virtual Channel (VC) cross connected networks; Part 3: VP Performance management

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Foreword

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

The present document is part 3 of a multi-part deliverable covering the management information model for the X-type interface between Operations Systems (OSs) of a Virtual Path (VP)/Virtual Channel (VC) cross connected network, as identified below:

Part 1: "Configuration management";

Part 2: "Alarm management";

Part 3: "VP Performance management".

(VC Performance Management aspects are for further study).

National transposition dates

Date of adoption of this EN:	24 November 2000
Date of latest announcement of this EN (doa):	28 February 2001
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 August 2001
Date of withdrawal of any conflicting National Standard (dow):	31 August 2001

Note that in contrast to parts 1 and 2, the present document (part 3) is restricted to aspects associated with VP Performance Management and that an extension to VC Performance Management remains for further study and development.

1   Scope

The present document addresses the requirements of network and service providers of Asynchronous Transfer Mode (ATM) cross connected networks for managing the exchange of performance monitoring information associated with the Virtual Path (VP) connections, which span several administrative ATM domains. These requirements are satisfied by the use of a standardized interface (the "X-interface") between Operation Systems (OSs) belonging to different Providing Network Operators (PNOs).

Readers of The present document should be made aware that the abbreviation 'PNO' is taken to mean Providing Network Operator. In early versions of other related documents EN 300 820-1 [7], EN 300 820-2 [8], PNO was defined as Public Network Operator. The change in definition has been provided to reflect the change in market conditions for provision of interconnected telecommunications services. However, it is considered necessary to retain the abbreviation 'PNO' because it is found in many of the managed object definitions used to specify the X-interface. It would be disadvantageous to introduce major changes in these managed object definitions, which serve purely technical purposes for management of interconnections only.

The present document should be used in conjunction with EN 300 820-1 [7] and EN 300 820-2 [8].

The present document describes the X-interface VP performance management area covering the following aspects:

- the Management Services (MS) and Management Functions (MF) needed to provide the necessary management messages for performance degradations detected within ATM connections and the necessary Management Functions for co-ordination of performance monitoring;

- the management information crossing the X-interface. This management information specification uses the Guidelines for the Definition of Managed Objects (GDMO) formalism, described in ITU-T Recommendation X.722 [11].

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.

- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1]   ITU-T Recommendation I.357: "B-ISDN semi-permanent connection availability".

[2]   ITU-T Recommendation I.356: "B-ISDN ATM layer cell transfer performance".

[3]   ITU-T Recommendation I.610: "B-ISDN operation and maintenance principles and functions".

[4]   ISO/IEC 10165-2: "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

[5]   ITU-T Recommendation M.3100: "Generic network information model".

[6]   ITU-T Recommendation I.751: "Asynchronous transfer mode management of the network element view".

[7]   ETSI EN 300 820-1: "Telecommunications Management Network (TMN); Asynchronous Transfer Mode (ATM) Management information model for X interface between Operation Systems (OSs) of a Virtual Path (VP)/Virtual Channel (VC) cross connected networks; Part 1: Configuration management".

[8]   ETSI EN 300 820-2: "Telecommunications Management Network (TMN); Asynchronous Transfer Mode (ATM) management information model for the X interface between Operation Systems (OSs) of a Virtual Path (VP)/Virtual Channel (VC) cross connected networks; Part 2: Alarm management".

[9]   ETSI ES 200 653: "Telecommunications Management Network (TMN); Network level generic class library".

[10]   ITU-T Recommendation X.721: "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information" (ISO/IEC 10165-3).

[11]   ITU-T Recommendation X.722: "Information technology - Open Systems Interconnection - Structure of Management Information: Guidelines for the definition of managed objects" (ISO/IEC 10165-4).

[12]   ITU-T Recommendation X.710 | ISO/IEC 9595: "Data Communication Networks: Open Systems Interconnection; Management - Common Management Information Service Definition".

[13]   ITU-T Recommendation X.711 | ISO/IEC 9596-1: "Common Management Information protocol specification for CCITT applications".

3   Definitions, symbols and abbreviations

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

PNO (Providing Network Operator): operator able to provide network resources to customers

- **Topological Components**

None of the topological components can be created or modified, in terms of characteristics, with management functions across the X-interface, since they represent physical resources:

inter-PNO Physical Link (IPPL): it represents a physical link that offers bidirectional transmission capabilities and connects two pnoVpSubnetworks. Each Inter-PNO Physical Link is terminated by two pnoNWAtmAccessPoints which are in charge of emitting notifications in case of failures related to the link or to the access point itself. An IPPL can be realized by any transmission capability (SDH, PDH etc.). There is no explicit managed object defined that represents this resource. Information about IPPLs is included in the interPnoTopologicalSubnetworkPair object

interPnoTopologicalSubnetworkPair: it represents the connectivity between the VP Subnetworks of two PNOs, and it includes one or a bundle of IPPLs that actually provide this connectivity

pnoVpSubnetwork: topological component used to effect routing and management of ATM cells. It describes the potential for setting up "ATM-VP connections" across the subnetwork. The pnoVpSubnetworks are delineated by ATM AccessPoints and interconnected by "inter-PNO Physical links".
A pnoVpSubnetwork can be partitioned into interconnected "sub-networks" and "links", but this partitioning is not shown over X-interface. In the context of The present document, one pnoVpSubnetwork represents an ATM network belonging to one PNO

- **Transport entities**

Transport entities provide transparent information transfer across the network. There is no information change between input and output other than that resulting from degradation in the transfer process:

sub-network connection: subnetwork connection is capable of transferring information transparently across a subnetwork. It is delimited by connection termination points at the boundary of the subnetwork and represents the association between these connection points

pnoVpSubnetworkConnection: pnoVpSubnetworkConnection represents a bidirectional portion of a VP connection across a PNO subnetwork. It transports ATM cells from one pnoNWAtmAccessPoint to another. This connection is seen by the I-PNO through the X-interface as a whole, with no details regarding the way the connection is composed inside the involved PNOs domains.
If a failure on subnetwork connection occurs this managed object emits a failure notification concerning the subnetwork connection portion of the VP Connection

Vp Link Connection: VP connection crossing a number of PNO administrative domains can be partitioned into VP Subnetwork Connections and VP Link Connections. The latter represent the part of the overall connection that run over an Inter-PNO Physical Link

-	**Reference points**

pnoNWAtmAccessPoint: it represents the access point to the ATM PNO Subnetwork, or in some cases, it represents an endpoint of a Inter-PNO Physical Link at the cell level. Each IPPL is terminated by two pnoNWAtmAccessPoint which are in charge of emitting Fault Notifications when detecting failures related to the link or the access point itself

pnoVpCTP: this resource represents an endpoint of a pnoVpSubnetworkConnection (and therefore of a VP Link Connection as well). Instances of this object class are contained in pnoNWAtmAccessPoints. A pnoVpCTP maps to the VPidentifier of the virtual path

# 3.2	Abbreviations

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

AP	Access Point
A-PNO	Originating PNO
ASN.1	Abstract Syntax Notation 1
ATM	Asynchronous Transfer Mode
CDV	Cell Delay Variation
CER	Cell Error Ratio
CLR	Cell Loss Ratio
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
CMR	Cell Misinsertion Rate
CTP	Connection Termination Point
ER	Entity Relationship
GDMO	Guidelines for the Definition of Managed Objects
INMS	Inter-operator Network Management System
I-PNO	Initiating PNO
IPPL	Inter-PNO Physical Link
LC	Link Connection
MIB	Management Information Base
MO	Managed Object
MOC	Managed Object Class
NE	Network Element
NMS	Network Management System
OAM	Operation And Maintenance
PM	Performance Management
PNO	Providing Network Operator
QoS	Quality of Service
SECBR	Severely Errored Cell Block Ratio
SES_{ATM}	Severely Errored Seconds of an ATM connection
SNC	SubNetwork Connection
TMN	Telecommunications Management Network
T-PNO	Transit PNO
VP	Virtual Path
VPCTP	Virtual Path Connection Termination Point
Z-PNO	Terminating PNO

4   Requirements

1) In case of performance problems, it should be possible to localize performance problems on a PNO sub-network and/or IPPL level.

2) It should be possible to indicate threshold crossed and unavailable time problems on a PNO sub-network and/or IPPL level, formerly agreed in a configuration management request for a certain QoS class.

3) All performance problems information passed across the X-interface should be time-stamped.

4) It should be possible to start and stop performance monitoring on request.

5) It should be possible to set and modify additional thresholds.

5   Management services

The following MFSs for Performance management have been identified:

Read Performance Data

-   (request to read the value of one or several measured performance parameters, for a particular VP Subnetwork Connection/VP Link Connection by the I-PNO).

Performance Alarm Reporting and Logging

-   (notification and logging of performance alarms).

Performance Alarm Log Inspection

-   (log consultation on reported performance alarms).

Performance Management Co-ordination

-   (for the I-PNO to request an A, T or Z PNO to Start/Stop the performance monitoring process of the VP SNC or LC and the setting or modification of PM additional thresholds).

All alarms due to performance degradation have a warning, the severity of which is indicated. The underlying resource has no state change associated with the PM alarm.

Each MFS is described by a set of messages that are sent between PNOs. PNO internal activities initiated by incoming messages are described only as necessary for the description of the X-interface message exchanges. The order in which the different messages are issued is illustrated by the use of Message Sequence Charts.

It should be noted that only the main parameters are indicated in the Sequence Charts. The full list of parameters per message and the parameter value range can be obtained from the ASN.1 and GDMO description. It should also be noted that the MFS described here only cover the normal flow of events and the most important error cases, not the invalid or unexpected behaviours.

An MFS is decomposed into a set of one or several MFs. The 4 MFS in this specification are listed hereafter, together with the related MFs:

-   MFS Read Performance Data;

-   MF Read Performance Data (RPD);

-   MFS Performance Alarm Reporting and Logging;

-   MF Unavailable Time Notification (UTN);

-   MF Threshold Crossed Notification (TCN);

-   MFS Performance Alarm Log Inspection;

-   MF Performance Log Inspection (PLI);

- MFS Performance Measurement Co-ordination;

- MF PM Additional Thresholds Setting/Modification (TSM);

- MF Start/Stop PM on a Subnetwork Connection (STSNCPM);

- MF Start/Stop PM on a Link Connection (STLCPM).

5.1   MFS Read Performance Data

This MFS enables the I-PNO to read performance data from the A-, T- or Z-PNOs.

Each PNO will, if requested by the I-PNO, collect performance data for the active semi-permanent VP connections within its domain. How this information is collected is an internal matter for each PNO and hence beyond the scope of this MFS. This MFS describes how performance data information held within the domain of the A-, T- or Z-PNO can be read by the I-PNO.

The Read Performance Data MFS contains one Management Function: Read Performance Data (RPD).

5.1.1   MF Read Performance Data (RPD)

This MF enables the I-PNO to get performance data related to its connections from another PNO.

Each PNO that provides monitored VP Subnetwork Connection and VPLink Connection resources has, if requested, to collect by any internal means, the performance information from its ATM network to provide performance data related to the following resources: VP Subnetwork Connections and VP Link Connections.

In each PNO MIB this network level performance information is contained in up to three pnoPerformanceData ObjectClass Instances per monitored connection:

- one for the Vp Subnetwork Connection for both directions of transmission (named by a pnoSNCBidirectionalPerformanceMonitor object);

- one for the VP Link Connection towards the A-PNO for one transmission direction (named by a pnoLCBidirectionalPerformanceMonitor object);

- one for the VP Link Connection towards the Z-PNO for one transmission direction (named by a pnoLCBidirectionalPerformanceMonitor object).

This means that an A- or Z-PNO may only have one instance of Performance Data object for VP Link Connection monitoring purposes.

Although performance information held by the pnoPerformanceData object is supposed to be "real time " information, the frequency at which the performance information visible on the X-interface is updated could be relatively low and depends on the different PNOs. The duration between two successive updates of performance parameters is called the scanPeriod. The scanPeriod value is read-only across the X- interface and the way this value is set is outside the scope of the interface definition. The information in the Performance Data will be updated as a result of internal performance processing activities within a PNO domain.

For a given connection the performance information related to A, T and Z-PNOs Subnetwork and Link Connections can only be read by the I-PNO. The M-GET CMISE service is used for reading the attributes of the pnoPerformanceData object instances.

The I-PNO acts as the Manager and the PNO receiving the request acts as the Agent. The parameters that the manager will receive include the following:

- the values of the performance ratios to be read (e.g. atoZCER, atoZCLR0, etc.);

- scanPeriod, which represents the time interval between two successive updates of performance parameters. It is read-only;

- offsetTime, which represents the difference between the current time and the time of the last update of the performance parameters. It is read-only;

- unavailabilityState, which indicates if the connection is in an unavailable state or not, based on the definition from ITU-T Recommendation I.357 [1];

- pnoGaugeThresholdAttributeList, which contains the threshold(s) associated with the requested QoS class for the connection;

- additionalGaugeThresholdAttributeList, which contains the additional thresholds set by the I-PNO.

The reading operation can be performed at any time and it is possible as long as the object instance exists. Consequently, if the monitored connection is in an inactive state, reading of performance information is possible but should return the NULL value.
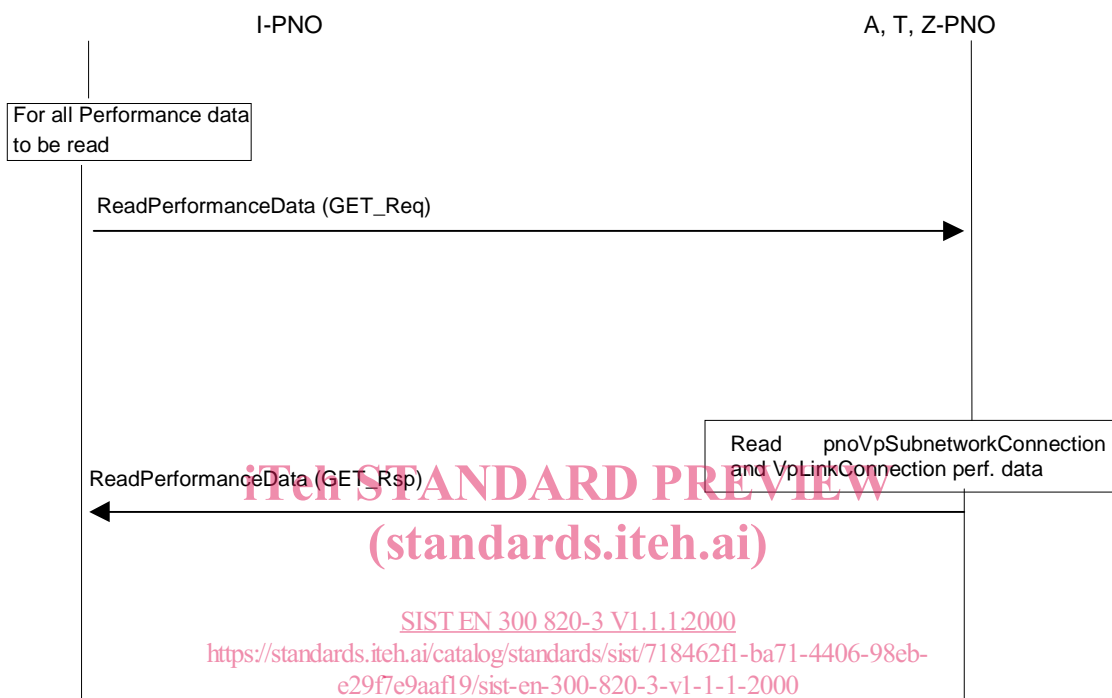

Figure 1: Read Performance Data

5.2 MFS Performance Alarm Reporting and Logging

A Performance alarm notification is sent to the I-PNO across the X-interface whenever performance degradation occurs in the A, T or Z PNO domain.

In order for an X-interface performance alarm notification to be sent from the A, T or Z PNO to the I-PNO at least one of the attributes, that reflects the actual performance data of a VP Subnetwork Connection or VP Link Connection, must cross the threshold kept in the pnoGaugeThresholdAttributeList attribute or in the additionalGaugeThresholdAttributeList attribute. Alternatively a notification is sent if the VP Subnetwork Connection begins or ends an unavailability period.

The MFS Performance Alarm Reporting and Logging contains two different Management Functions.

The first one handles the case when a VP Subnetwork Connection enters or leaves an unavailability period, MF Unavailable Time Notification (UTN). The perceived severity field in the notification is set to "Warning" to indicate the beginning of the performance alarm and to "Cleared" to indicate the end.

The other MF Threshold Crossed Notification (TCN) is emitted when at least one of the performance parameters associated with the resource crosses a threshold requested by the I-PNO (either to indicate a performance degradation or a performance restoration respectively for the monitored VP connection).

After sending either kind of notification, the agent PNO has to store it in the Performance Log in its MIB, so that it can be read at any time by the I-PNO to which it was sent. The logging function is part of the two MFs described here while the Log Reading functionality is covered by the Performance Alarm Log Inspection MFS.

Reception:

A Performance Alarm is received by the I-PNO across the X-interface if the INMS of the A-, T-, or Z-PNOs sends one. The subsequent processing of the message by the I-PNO (e.g. displaying) is outside the scope of The present document.

5.2.1   MF Unavailable Time Notification (UTN)

An Unavailable Time Notification is sent to the I-PNO across the X- interface whenever a VP Subnetwork Connection or VP Link Connection owned by this I-PNO becomes unavailable and when it becomes available again.
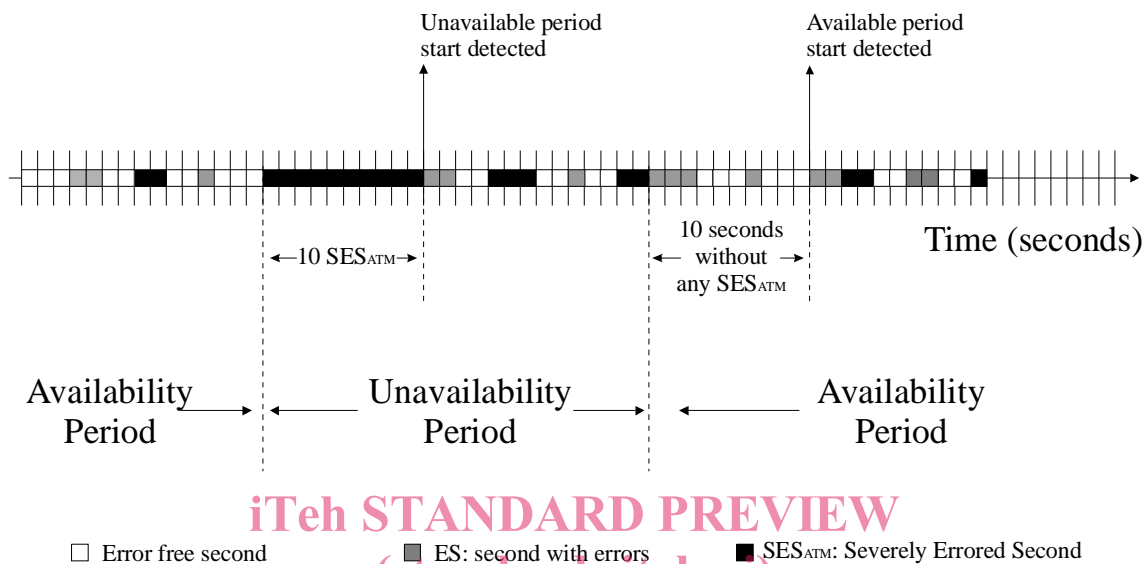

Figure 2: A VP connection Entering and Leaving the Unavailability period

As shown in figures 2 and 3, an unavailable time event message indicating that the VP connection is in the unavailable state is sent out defining when the VP connection was in the available state before and ten consecutive SESATM events have occurred. The VPC then enters the unavailability period and the ten SESATM are part of the unavailable time. The SESATM are detected with the OAM flow continuity check (see ITU-T Recommendation I.610 [3]).

The connection is considered to be in the available state again when for 10 consecutive seconds no SES_{ATM} event occur, and these ten seconds are part of the available time.

The unavailable time event message is sent to the I-PNO across the X-interface as a QoS Alarm notification.

After sending the message, the agent PNO appends the Performance Alarm record in the standard MO PerfLog in its MIB. The record will be deleted after a certain time that is not standardized, but rather agreed bilaterally by the PNOs.