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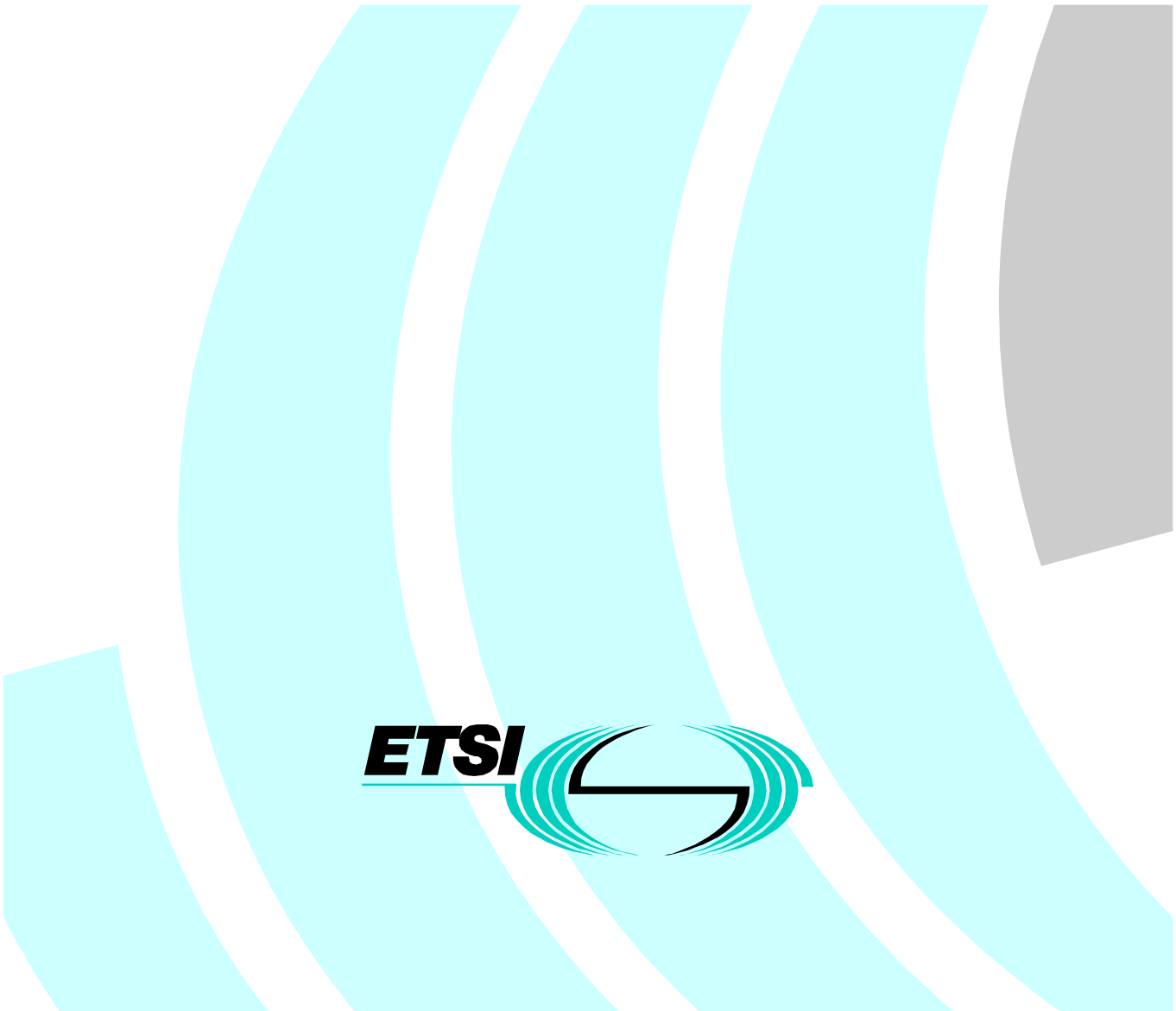
European Standard (Telecommunications series)

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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Contents

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Foreword

This European Standard (Telecommunication series) has been produced by ETSI Technical Committee Telecommunications Management Network (TMN), and is now submitted for the ETSI standards Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document is part 1 of a multi-part EN 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)

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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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 Parts 1 and 2 of the standard EN 300 820-1 [7] , 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] 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] 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] 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).

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.

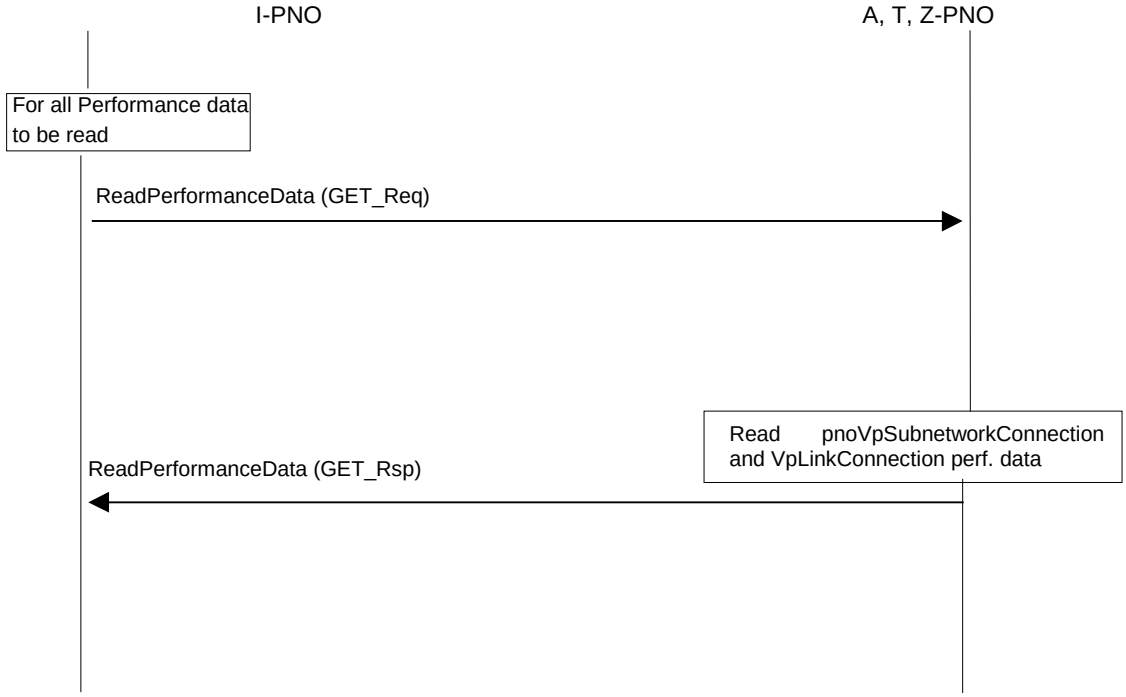

Figure 1: Read Performance Data

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.

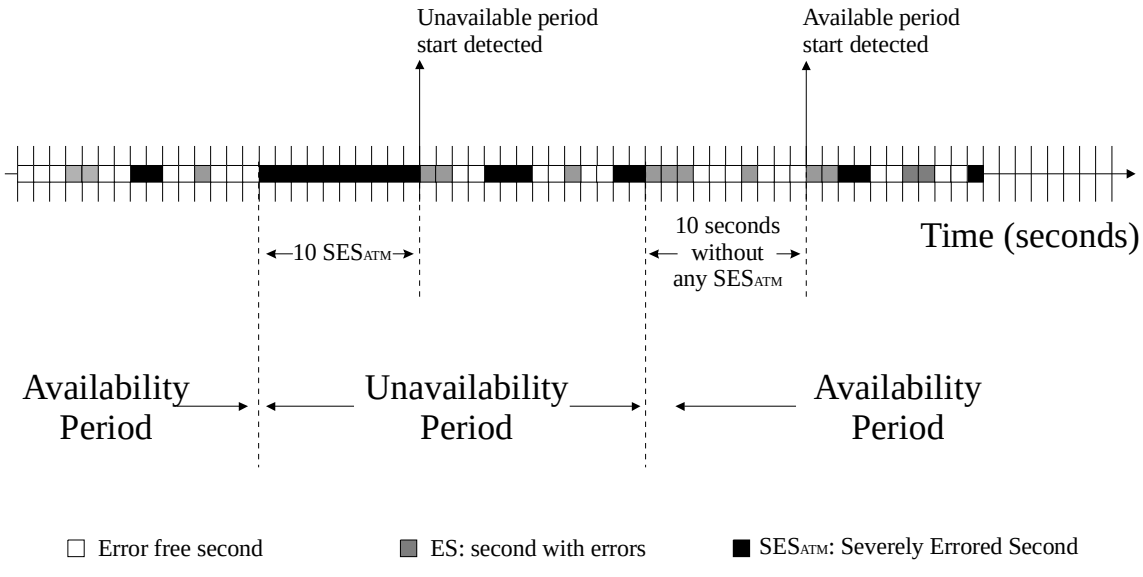

Figure 2: A VP connection Entering and Leaving the Unavailability period

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.

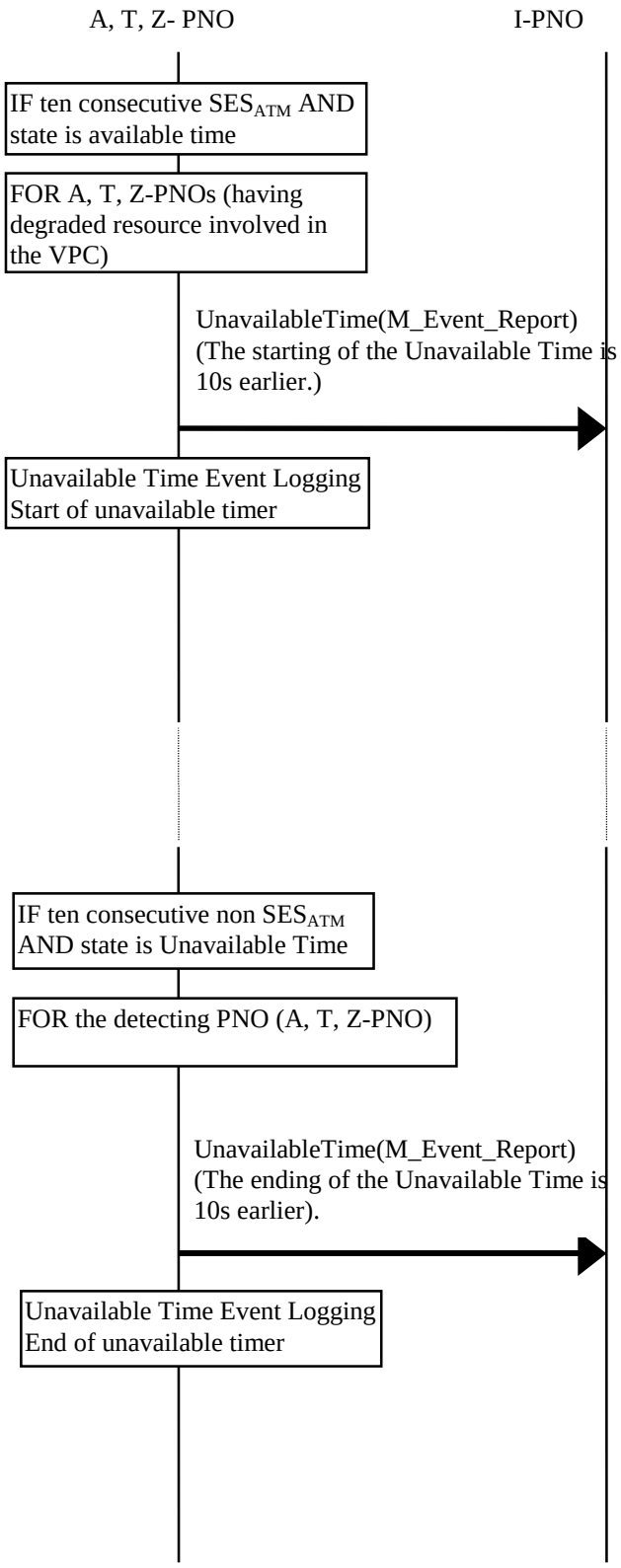

Figure 3: The notification of the Unavailable Period event

5.2.2 MF Threshold Crossed Notification (TCN)

The MF Threshold Crossed Notification is initiated when a Performance Threshold is crossed by at least one of the observed current performance parameters (see figure 4). After each interval of time, set with the scanPeriod attribute, the performance parameters held in the pnoPerformanceData object have to be updated. Each time that the data related to performance is updated, the new values should automatically be matched against the threshold values, contained in the pnoGaugeThresholdAttributeList object and in the additionalGaugeThresholdAttributeList object. If any of the thresholds are crossed a notification should be sent. There is a maximum of one Threshold Crossed notification per parameter during the same observation period identified by the scanPeriod attribute.

It should be noted that in the case where a threshold is crossed and back to a normal value within the same scanPeriod, there is no QoSAlarm notification reported to the I-PNO.

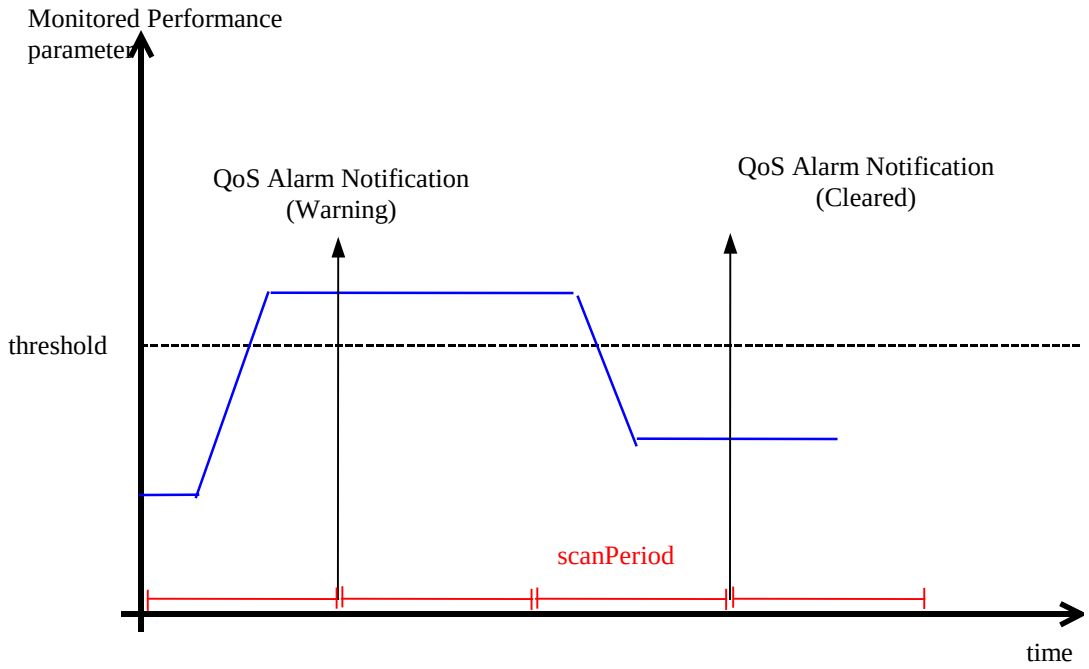

Figure 4: Occurrence of QoS Alarm and QoS Alarm Clearance Notification

The Threshold Crossed event message is sent to the I-PNO across the X-interface as a QoS Alarm notification. For the monitored VP Subnetwork Connection and VP Link Connection the Performance Data MO instances belonging to that PNO emit a QoS Alarm notification when a threshold crossing has been detected.

The monitored parameters are those described in ITU-T Recommendation I.356 [2] , and the threshold values are indicated in the QoS table in Annex 1.

The notification sent includes the following parameters:

- probable cause, which is set to "Threshold Crossed";
- perceived severity, which is set to "Warning" to indicate that the performance has been degraded and to "Cleared" to indicate that the performance has been restored for this parameter (other parameters could possibly be in a 'threshold crossed' status. It is only when all the TCs are cleared that the performance is completely restored);
- thresholdInfo which includes the parameter that triggered the notification, the value of threshold crossed, and the actual measured attribute value;
- additionalInformation, that tells if the notification is related to the VP Subnetwork Connection, to the VP Link Connection towards the A-end or to the VP Link Connection towards the Z-end.

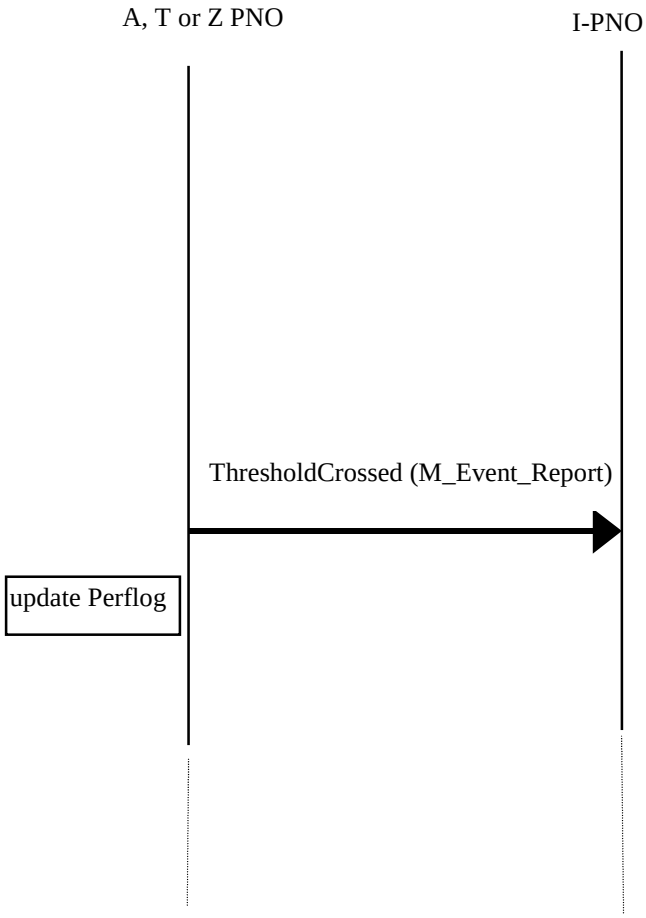

Figure 5: The notification of a Threshold Crossed Event.

After sending this notification, the agent PNO copies it in the Performance Alarm Record and appends it in the standard MO PerfLog in its MIB. The record will be deleted only after a certain amount of time which is not standardized, but rather agreed bilaterally by the PNOs.

5.3 MFS Performance Alarm Log Inspection

This MFS enables the I-PNO to read stored performance alarm messages previously sent to it by the A-, T- or Z-PNO. This is possible due to the previous MFS that includes standard logging of the alarms sent by the PNO acting as agent.

5.3.1 MF Performance Log Inspection (PLI).

In the Performance Alarm Log Inspection MFS, there is only one MF called the Performance Log Inspection MF (PLI). This allows a PNO acting as a manager (i.e. the I-PNO for a connection) to read the Performance alarm logs of the A-, T- or Z-PNO for that connection across the X-interface.

In the PLI MF, the I-PNO requests to read the sent alarm log of another PNO (A, Z or T) that receives the request, checks it and if it is valid returns the response to the I-PNO (either a failure, or the alarm record(s) requested).

The sequence of messages that can be exchanged across the X-interface between the requesting (I) PNO and the responding (A, T or Z) PNO for the Performance Log Inspection is given in Figure 6.

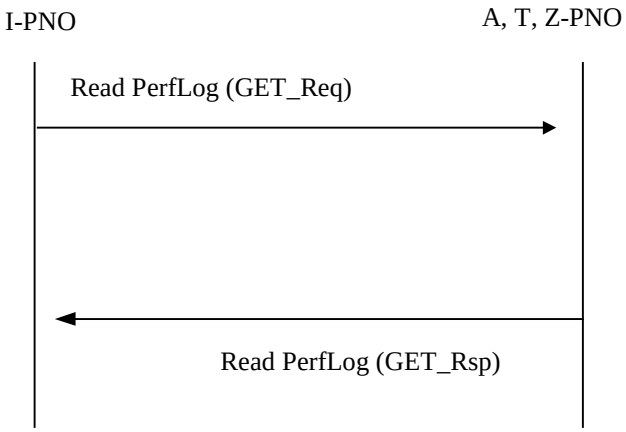

Figure 6: The perfLog Inspection

It is advisable that a filtering mechanism is applied when a PLI request is made, so that only the PerfLog information related to the connection of interest is sent back in the response.

5.4 MFS Performance Measurement Co-ordination (PMC)

This MFS enables the I-PNO to co-ordinate the performance monitoring information of the different VP Subnetwork and Link Connections in the A-, T- and Z-PNOs domains into the performance information for the end-to-end VP connection under its responsibility. This MFS contains two types of functionalities: MF Additional Threshold Setting/Modification and MF Start/Stop.

5.4.1 MF Additional Threshold Setting/Modification.

This MF enables the I-PNO to request the setting or the modification of the values for the additional thresholds of a VP Subnetwork Connection and/or a VP Link Connection; refer to Figure 7. The A-, T- or Z-PNO responds to the request of the I-PNO either with a threshold set/modification information or with a failure indication. Please note that the regular thresholds cannot be set or modified with this MF. The regular thresholds are set by default in the reserve request which specifies the "VpQoSClass". The mapping between the value (0…99) of this integer and the performance parameters is done by the QoS table (see Annex A).

If an alarm condition exists previous to the occurrence of a threshold value change (i.e. an old threshold had been violated) and the current value of the measurement is within the allowable range of the new threshold value, then a QoS alarm notification is emitted with the severity field set to "Cleared". If the new threshold value is set within the range of the old threshold value, so that the new threshold is also violated, a QoS alarm notification is emitted even if an alarm condition is already outstanding.

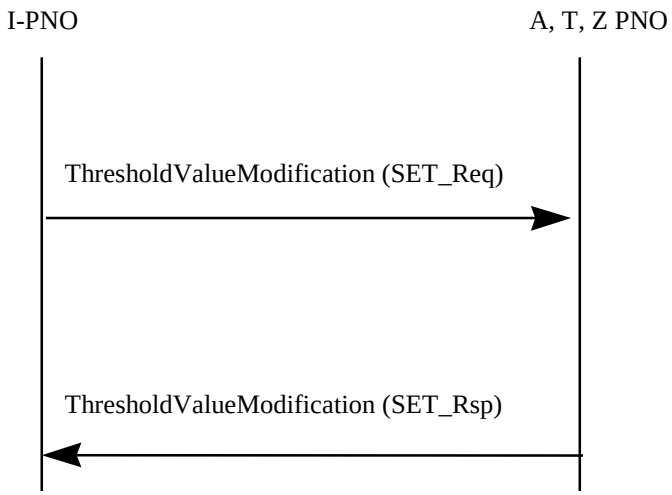

Figure 7: Additional Threshold Setting/Modification

5.4.2 MF Start/Stop of the Performance Monitoring (STPM).

The performance monitoring on a VP Subnetwork Connection will be started whenever requested by the I-PNO for that connection and it will be stopped either when the connection is deactivated or whenever explicitly requested by the I-PNO.

If the connection is activated and deactivated during its reservation lifetime, several different situations could arise:

- The monitoring process has been explicitly started by the I-PNO at a moment in which the connection is deactivated.
  - In this case the monitoring should start as soon as the connection is activated.
- The monitoring process has been explicitly started by the I-PNO at a moment in which the connection is active and after that, the connection is deactivated and activated again, without any explicit "stop monitoring" request being received.
  - In this case the monitoring should be started when requested, stopped when the connection is deactivated and automatically restarted when the connection is reactivated.
- The connection is deactivated and therefore not being monitored, but the monitoring process is supposed to start as soon as the connection is reactivated and the I-PNO issues an explicit request to stop the monitoring.
  - The monitoring process will **not** be started when the connection is reactivated.

To perform this behaviour, the attributes sinkPMRequest and sourcePMRequest are used to indicate if performance monitoring is requested.

5.4.2.1 MF Start/Stop PM on a SubNetworkConnection (STSNCPM)

The performance monitoring will be started when the administrativeState of a pnoVpSubnetworkConnection has the state UNLOCKED and one of the two attributes sinkPMRequest and/or sourcePMRequest of the pnoSNCBidirectionalPerformanceMonitor indicates that performance monitoring has been requested

The values of the attributes sinkPMRequest and sourcePMRequest are set with the pnoSNCControlPM Action belonging to the pnoSNCBidirectionalPerformanceMonitor object class.

Therefore, the attributes SinkPMRequest and SourcePMRequest will determine the role of the Access Point at the A-end, and the Access Point on the other end will necessarily take the opposite role. Only those two attributes, sinkPMRequest and sourcePMRequest, are needed to control the performance monitoring within the subnetwork connection. The reason is that if OAM cells are to be introduced in the pnoNWAtmAccessPoint at one end of the Subnetwork Connection, the pnoNWAtmAccessPoint at the other end of the subnetwork connection has to be ready to collect those OAM cells.

NOTE: Sink/Source order of activation = the Sink has to be activated before the Source.

Figure 8 shows the message interactions needed to start or stop the monitoring process with the pnoSNCControl Action

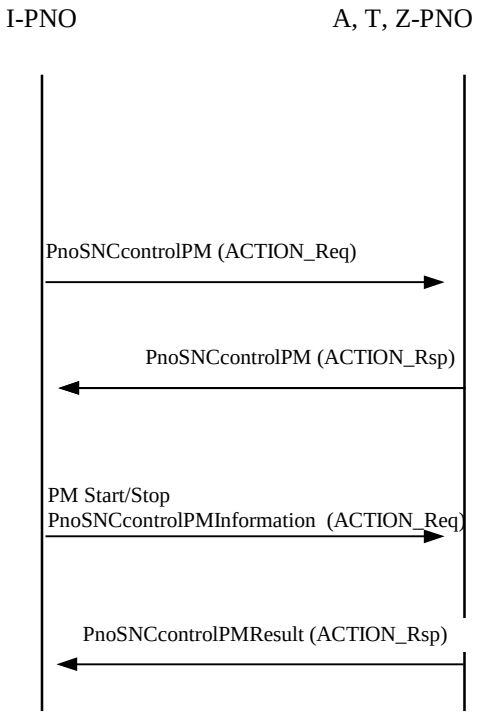

Figure 8: PM on a SubNetworkConnection.

5.4.2.2 MF Start/Stop PM on a LinkConnection (STLCPM).

The performance monitoring will be started when the administrativeState of a pnoVpSubnetworkConnection has the state UNLOCKED and one of the two attributes sinkPMRequest and/or sourcePMRequest of the pnoLCBidirectionalPerformanceMonitor indicates that performance monitoring has been requested.

The values of the attributes sinkPMRequest and sourcePMRequest are set with the pnoLCControlPM Action belonging to the pnoLCBidirectionalPerformanceMonitor object class.

The pnoLCControlPM Action will be used to indicate when the monitoring process is requested on a Link Connection. It can also be specified if the monitoring is to be performed in both directions or only in one, and, in that case, in which one.

NOTE: Sink/Source order of activation = the Sink has to be activated before the Source.

Figure 9 shows the message interactions needed to start or stop the monitoring process with the pnoLCControl Action

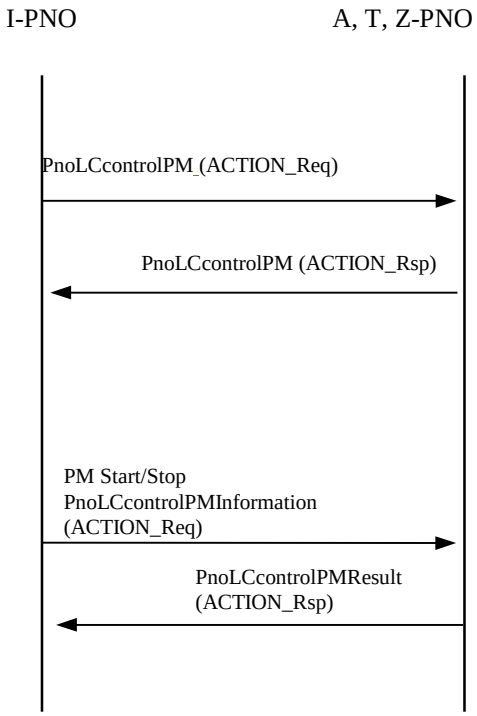

Figure 9: PM of a link connection

5.5 Ensemble Scenarios

5.5.1 Introduction

This section defines the Ensemble scenarios. Each of these definitions consists of brief textual descriptions and message flow diagrams.

The scenarios are used to show how the managed objects in the information model can be used to accomplish the function listed in subclauses 5.1 to 5.4.

In the scenarios that follow, CMIP **Error! Reference source not found.** flows between (and corresponding CMIS 0 primitives within) manager and agent systems are indicated by arrows with a three character abbreviation for request, indicate, response and confirm primitives shown at the head and tail of the arrow. For example:

o-- Req ---------- Ind -->
CMIS request
<-- Cnf ---------- Rsp --o
CMIS response

NOTE 1: CMIS information in italics denotes parameters described in the sequence charts. No OPTIONAL parts are included.

NOTE 2: It should be noted that the local distinguished name is used to address the Base Object Instance for all scenarios described in subclause 5.5.

5.5.2 MF Read Performance Data (RPD)

Manager Agent

o-Req----------Ind->

M-GET Request

```
Mode                                confirmed
Base Object Class                pnoLCBidirectionalPerformanceMonitor or
                                    pnoSNCBidirectionalPerformanceMonitor
Base Object Instance                locationId
Attribute Id List                { atoZCER,
                                 ztoACER,
                                 atoZCLR0,
                                 ztoACLR0,
                                 atoZCLR0+1,
                                 ztoACLR0+1,
                                 atoZCMR,
                                 ztoACMR,
                                 atoZSECBR,
                                 ztoASECBR,
                                 atoZCTD,
                                 ztoACTD,
                                 atoZCDV,
                                 ztoACDV,
                                 scanPeriod,
                                 offsetTime,
                                 pnoGaugeThresholdAttributeList,
additionalGaugeThresholdAttributeList }
Scope                            first level
```

Manager Agent

<-Cnf----------Rsp-o

M-GET Response

```
Managed Object Class                pnoPerformanceData
Managed Object Instance          pnoPerformanceDataId
Attribute List                          {atoZCER, attribute value,
                                        ztoACER, attribute value,
                                        atoZCLR0, attribute value,
                                        ztoACLR0, attribute value,
                                        atoZCLR0+1, attribute value,
                                        ztoACLR0+1, attribute value,
                                        atoZCMR, attribute value,
                                        ztoACMR, attribute value,
                                        atoZSECBR, attribute value,
                                        ztoASECBR, attribute value,
                                        atoZCTD, attribute value,
                                        ztoACTD, attribute value,
                                        atoZCDV, attribute value,
                                        ztoACDV, attribute value,
                                        scanPeriod, attribute value,
                                        offsetTime, attribute value,
                                        pnoGaugeThresholdAttributeList,
                                        attribute value, additionalGaugeThresholdAttributeList,
attribute value}
Errors                                  as in CMISE Rec. 0
```

NOTE: If the M-GET Request was sent to the pnoVpSubnetwork there is a possibility that more than one response will be returned because more than one pnoPerformanceData managed object may be respond to the request. In this case the responses will be returned as "linked replies".

5.5.3 MF Unavailable Time Notification (UTN)

The Unavailable Time event notification is sent to the I-PNO that is responsible for the VP connection to indicate that a monitoring (A, T, Z) PNO has detected that the VPC enters in the unavailable state. A perceived severity is set to "Warning".

Once the unavailable time is ended the Unavailable Time Notification is sent to the I-PNO to indicate that a monitoring (A, T, Z) PNO has detected that the VPC enters in the available state. A perceived severity is set to "Cleared".

Manager **Agent**

<-Ind------------------------------Req-o

M-EVENT-REPORT

```
Mode    non confirmed
Managed Object Class    pnoPerformanceData
Managed Object Instance pnoPerformanceDataId
Event Type  qualityOfService Alarm
Event Time  eventTime
Event Information   alarmInfo(
    probableCause="underlyingResourceUnavailable",
    perceivedSeverity="Warning/Cleared")
```

5.5.4 MF Threshold Crossed Notification (TCN)

The Threshold Crossed alarm event notification is sent to the I-PNO that is responsible for the VP connection to indicate that a (A, T, Z) PNO has detected across of one of the performance parameters thresholds and the performance of the VP connection has been degraded.

A perceived severity is set to "Warning".

Once the faulty parameter is back below the threshold, a Threshold Crossed alarm event notification is sent to the I-PNO by the (A, T, Z) PNO. This notification is sent only if this threshold crossing is done before the end of the scanPeriod. This is a rule to elaborate the X- interface view of the managed network. At the X-interfacelevel, there is no need to send all alarm notifications received from the NE.

A perceived severity is set to "Cleared".

Manager **Agent**

<-Ind---------------------------Req-o

M-EVENT-REPORT

```
Mode    non confirmed
Managed Object Class    pnoPerformanceData
Managed Object Instance pnoPerformanceDataId
Event Type  qualityOfServiceAlarm
Event Time  eventTime
Event Information   alarmInfo(
    probableCause="ThresholdCrossed",
    perceivedSeverity="Warning/Cleared")
    thresholdInfo(
        triggeredThreshold=AttributeId,
        observedValue=ObservedValue
        )
    )
```

5.5.5 MF PerfLog Inspection (PLI)

The I-PNO can request to read the perfLog(s) of a (A, T, Z)-PNO concerning a VP connection under the responsibility of the I-PNO. The requests can optionally use a filter. For clarity this ensemble will include a generic one as an example. Specific filters are defined in the test suite document. It should be noted that a set of responses can be generated by a single request.

Manager **Agent**

o-Req----------Ind->

M-GET Request

```
Mode    confirmed
Base Object Class   Log
Base Object Instance    logId = "PerfLog"
Attribute Id List   {
    managedObjectInstance,
    pnoPerformanceDataId,
    eventTime,
    eventType
    probableCause
    perceivedSeverity
    thresholdInfo}
Scope   The scope is the default scope  i.e. the base object
Filter  InspectionFilter
```

A generic inspection filter can be:

```
InspectionFilter    CMISFilter ::= item eventTime <bin_op> {Time}
    <operator> item pnoPerformanceDataId  equality {INTEGER}
    <operator> item eventType equality {event Type}
    <operator> item probableCause equality {INTEGER}
    <operator> item perceivedSeverity bin_op {INTEGER}
             <operator> item thresholdInfo bin_op {INTEGER}
where   <operator>: logical AND, or logical OR
    <bin_op>: greaterOrequal, lessOrequal or equality
```

Manager **Agent**

<-Cnf----------Rsp-o

M-GET Response

```
Managed Object Class    Log
Managed Object Instance logId ="PerfLog"
Attribute List  {
    managedObjectInstance
    pnoPerformanceDataId,
    eventTime,
    eventType
    probableCause
    perceivedSeverity
    thresholdInfo}
Errors  errors as specified in CMISE Rec. 0
```

5.5.6 MF Additional Threshold Setting/Modification

In order to set or modify additional thresholds the I-PNO will perform an M-SET in the attribute additionalGaugeThresholdAttributeList located in the pnoPerfomanceData object class contained by the bidirectional performance monitor object classes. It has to be taken into account that the attribute identifiers of the bidirectional performance monitor object classes are always known.

Manager Agent

o-Req----------Ind->

M-SET Request

```
Mode                            confirmed
Base Object Class                   pnoLCBidirectionalPerformanceMonitor or
pnoSNCBidirectionalPerformanceMonitor
Base Object Instance                    pnoSubnetworkId, subnetworkconnectionId, locationId
Scope                           first level
Modification List                   {additionalGaugeThresholdAttributeList,
                              attribute value, replace}
```

Manager Agent

<-Cnf----------Rsp-o

M-SET Response

```
Managed Object Class                pnoPerformanceData
Managed Object Instance             pnoPerformanceDataId
Attribute List                      {additionalGaugeThresholdAttributeList,
    attribute value}
Errors                          as in CMISE Rec. 0
```

5.5.7 MF Start/Stop PM on a VpSubNetworkConnection

The action pnoSNCControlPM is used to start the monitoring in a VP Subnetwork Connection. In order to accomplish it the I-PNO manager will have to perform one action in the involved subnetwork.

Manager Agent

o-Req----------Ind->

M-ACTION Request

```
Mode                            confirmed
Base Object Class                   pnoSNCBidirectionalPerformanceMonitor
Base Object Instance                    locationId
Action Type                         pnoSNCControlPM
Action type info                    pnoSNCControlPMInformation
```

Manager Agent

<-Cnf----------Ind-o

M-ACTION Response

```
Managed Object Class                pnoSNCBidirectionalPerformanceMonitor
Managed Object Instance             locationId
Action Type                     pnoSNCControlPM
Action Result                   pnoSNCControlPMResult
```

5.5.8 MF Start/Stop PM on a LinkConnection

The action pnoLCControlPM is used to start the monitoring in a VP Link Connection. In order to accomplish it the I-PNO manager will have to perform two M-ACTIONS, one in each of the two involved subnetworks.

It has to be taken into account that the attribute identifiers of the bidirectional performance monitor object classes are always known.

Manager Agent

o-Req----------Ind->

M-ACTION Request

```
Mode                          confirmed
Base Object Class                 pnoLCBidirectionalPerformanceMonitor
Base Object Instance                  locationId
Action Type                       pnoLCControlPM
Action type info                  pnoLCControlPMInformation
```

Manager Agent

<-Cnf----------Ind-o

M-ACTION Response

```
Managed Object Class              pnoLCBidirectionalPerformanceMonitor
Managed Object Instance           locationId
Action Type                   pnoLCControlPM
Action Result                 pnoLCControlPMResult
```

6 Management Information model

6.1 Introduction

6.1.1 Overview of the Managed Object Classes

The Information Model consists of managed object classes which support the implementation of this Performance Management Ensemble and the related VP/VC Configuration Management EN 300 820-1 [7] and VP/VC Alarm Reporting EN 300 820-2 Specifications. The model is derived from the Generic Object Model (GOM) ES 200 653 [9] .

The Information Model consists of managed object classes which support the implementation of this Performance Management Ensemble and the related VP/VC Configuration Management (EN 300 820-1 [7])and VP/VC Alarm Reporting (EN 300 820-1) Specifications. The model is derived from the Generic Object Model (GOM) (ES 200 653 [9]).

The managed object classes are mainly characterized by:

pnoVpSubnetwork: refer to definition in clause 3.1

interPnoTopologicalSubnetworkPair : refer to definition in clause 3.1

pnoVpSubnetworkConnection: refer to definition in clause 3.1

pnoNWAtmAccessPoint: refer to definition in clause 3.1

pnoVPCTP: refer to definition in clause 3.1

pnoPerformanceData: instances of this MOC are created/deleted whenever a request to start or stop the performance monitoring is received from the I-PNO. Instances of this MOC emit a QoS-Alarm notification as appropriate.

pnoSNCBidirectionalPerformanceMonitor: this logical resource is used to control the performance measurement activities on subnetwork connection of a monitored VP connection.

pnoLCBidirectionalPerformanceMonitor: this logical resource is used to control the performance measurement activities on link connection of a monitored VP connection.

log: log objects are used to record the notifications (fault alarms (SALog) or Performance alarms (PerfLog)) that an A, T, or Z-PNO sends to the I-PNO. The log records concerning failures or performance degradation about VP Subnetwork Connections or performance degradation on the VP Link Connection portions can only be read by the I-PNO that has initiated the VP Connection.

6.2 Inheritance tree

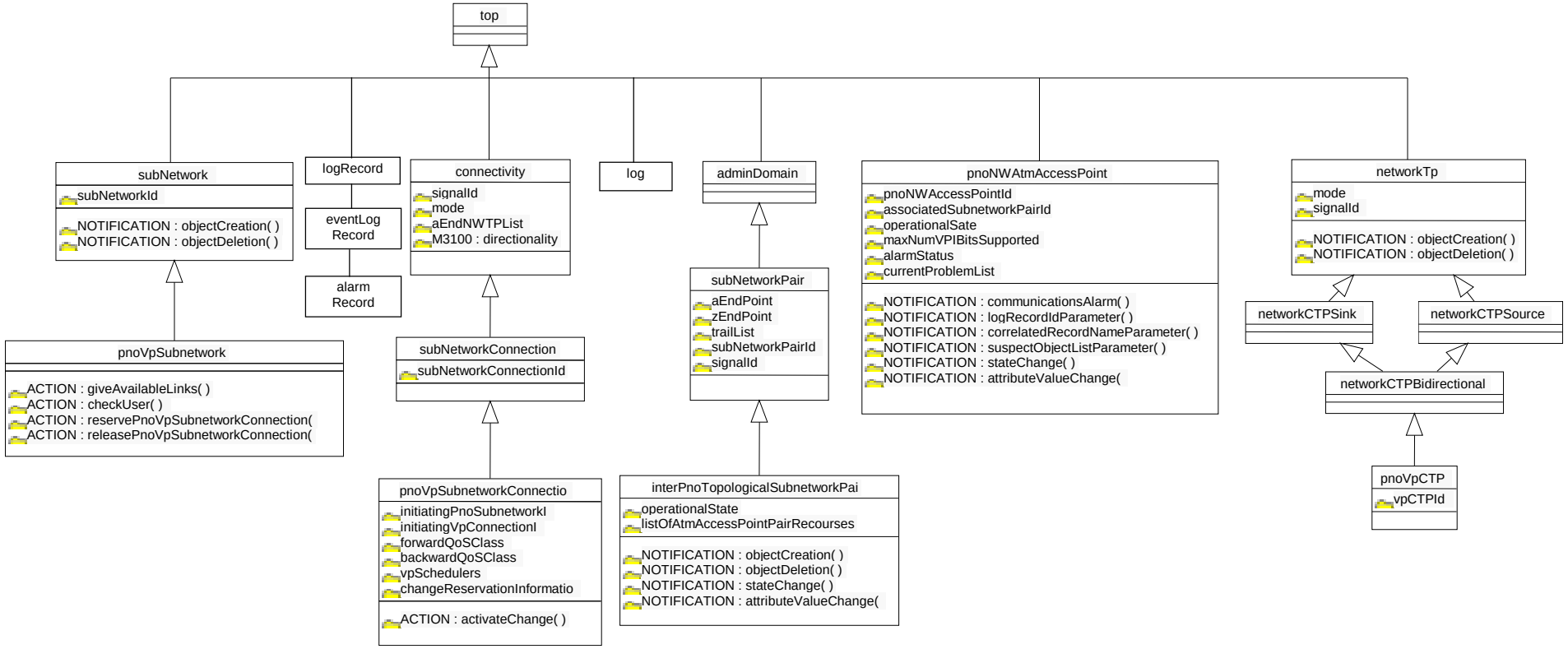

Figure 10: Inheritance Tree for CM object classes

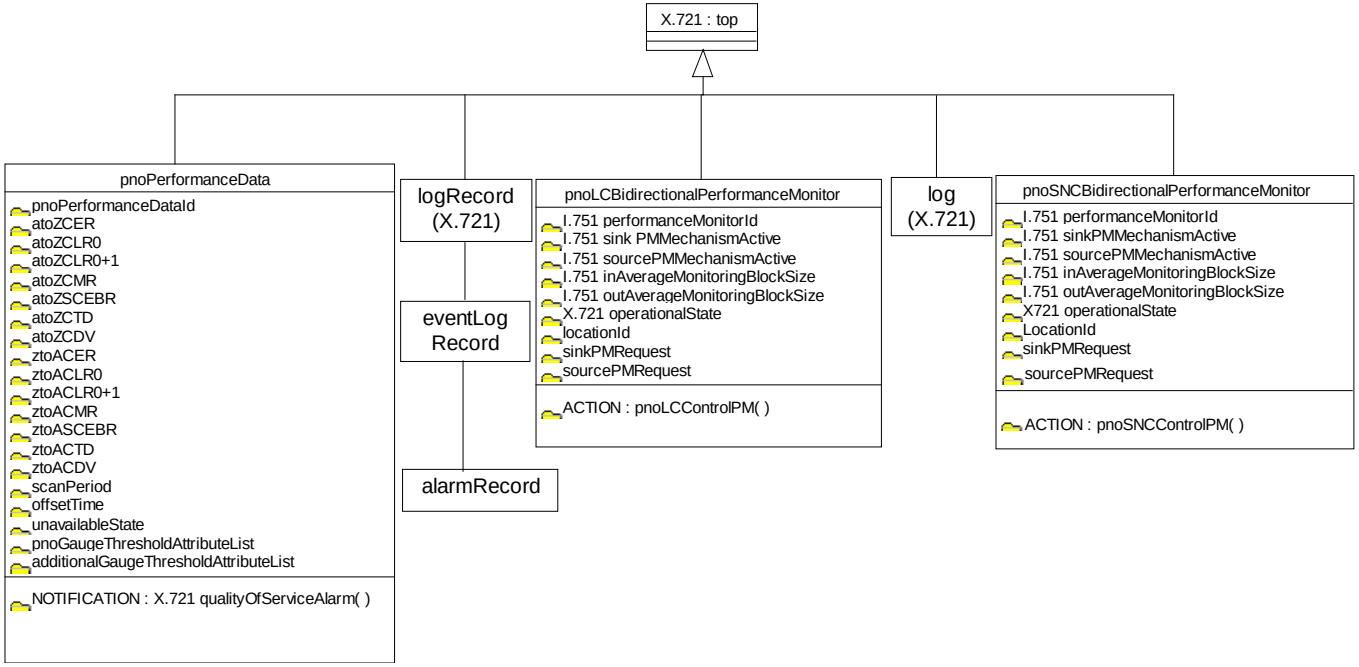

Figure 11: Inheritance Tree for PM object classes

6.3 Entity Relationship Diagram

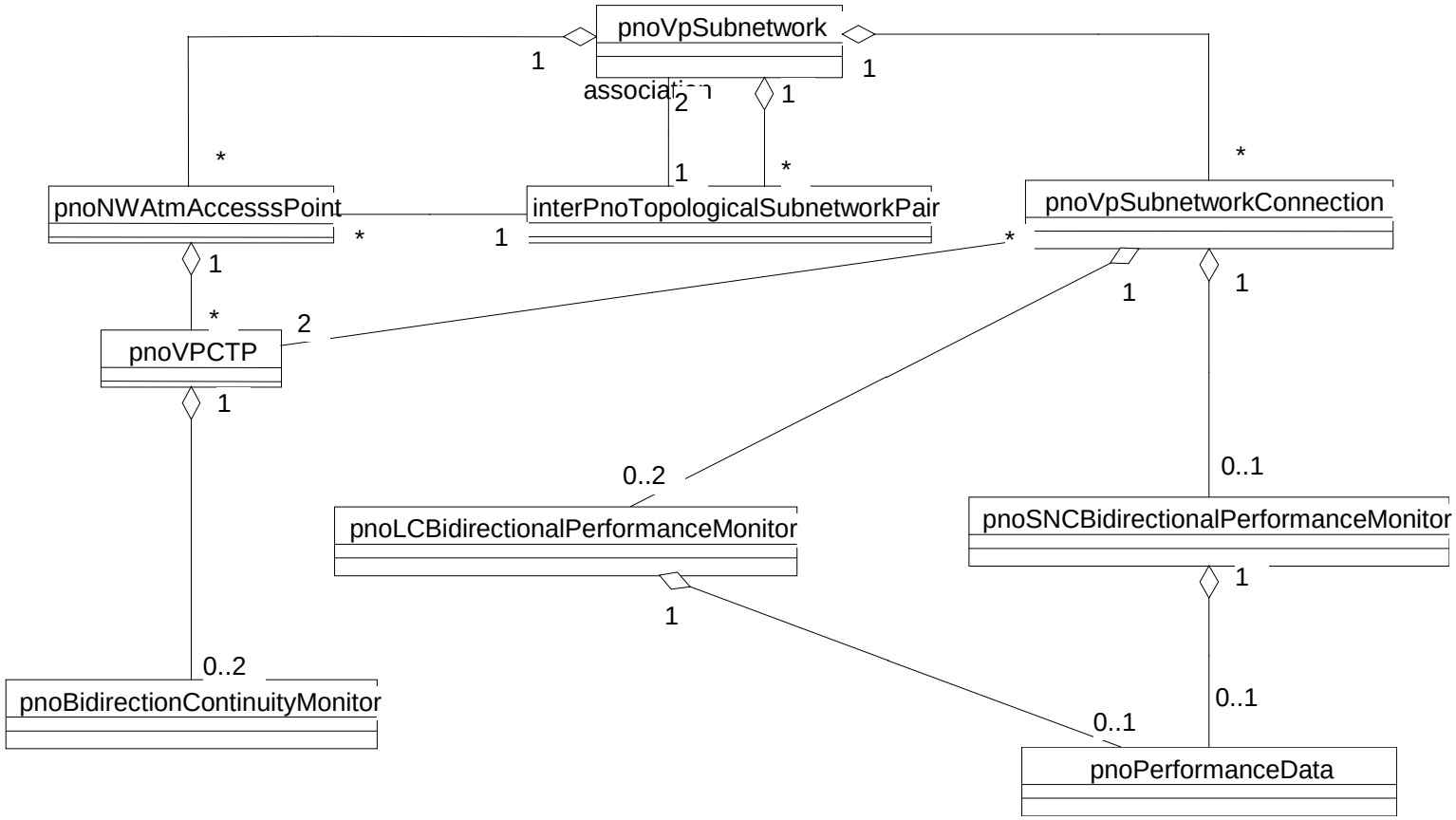

Figure 12: Entity Relationship diagram for PM object classes and CM object classes in UML notation

6.4 Name Binding

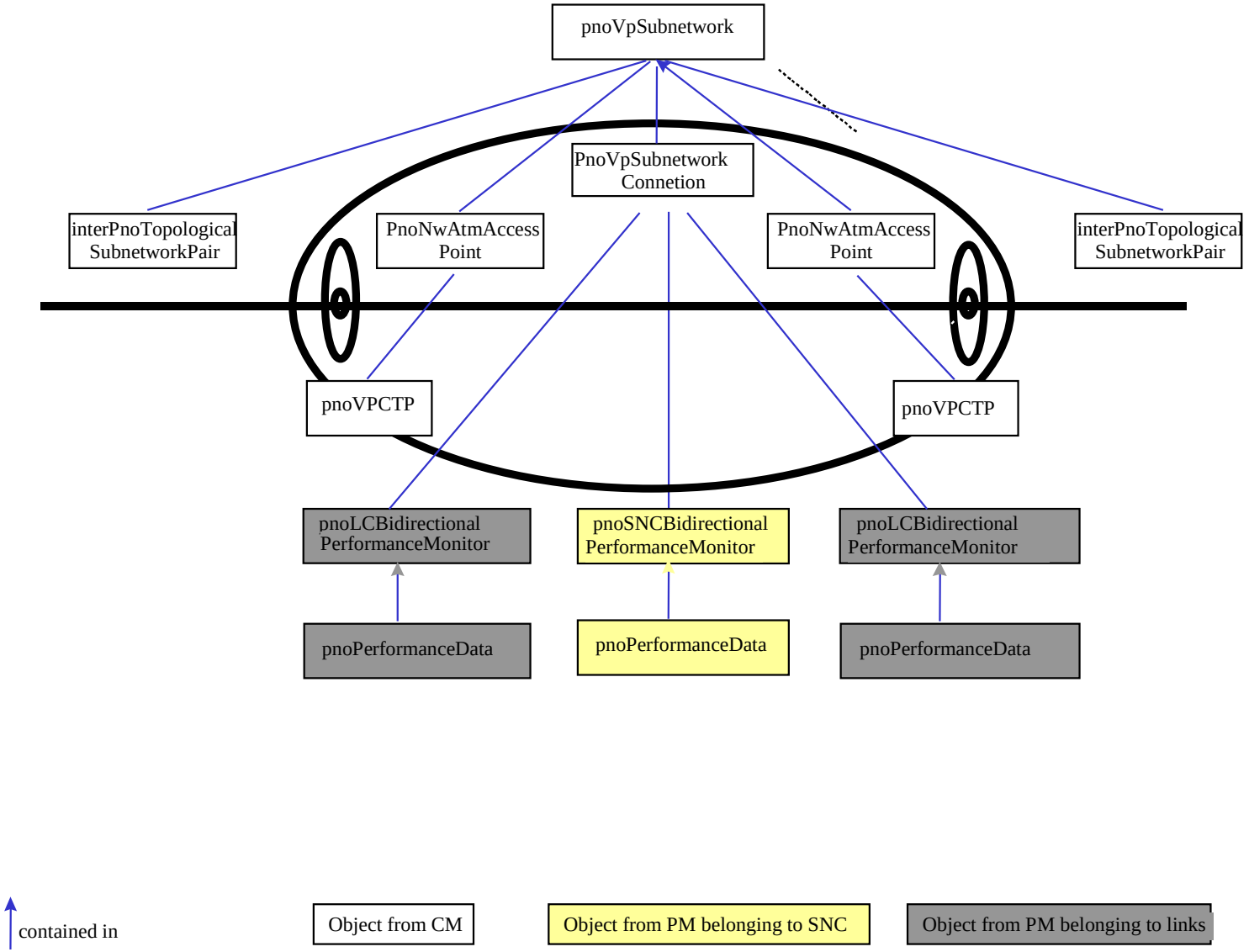

Figure 13: MIB for one Subnetwork

6.5 Restrictions on standardized Object Classes

Profile for ITU-T Recommendation X.721 [10**] top Object Class**

The conditional package allomorphicPackage will not be supported in any subclasses of top.

Profile for ITU-T Recommendation X.721 [10**] system Object Class**

None of the conditional packages of system will be supported (they are administrativeStatePackage and supportedFeaturesPackage).

Profile for ITU-T Recommendation X.721 [10**] Log Object Class**

None of the conditional packages of log will be supported (they are finiteLogSizeP, logAlarmP, availibilityStatusP, duration, dailySchedulingP, weeklySchedulingP and externalSchedulerP).

Three attributes are to be GET only (instead of GET-REPLACE): logFullAction, administrativeState and discriminatorConstruct. LogFullAction is fixed to "wrap".

6.6 Object Classes Definitions

```
pnoLCBidirectionalPerformanceMonitor MANAGED OBJECT CLASS
   DERIVED FROM       "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":top;
   CHARACTERIZED BY
      "Recommendation M.3100 [5] : 1992":stateChangeNotificationPackage,
      pnoLCBidirectionalPerformanceMonitorPackage;
REGISTERED AS {xatmObjectClass 15};
pnoPerformanceData MANAGED OBJECT CLASS
   DERIVED FROM       "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":top;
   CHARACTERIZED BY
      pnoPerformanceDataPkg;
REGISTERED AS {xatmObjectClass 16};
pnoSNCBidirectionalPerformanceMonitor MANAGED OBJECT CLASS
   DERIVED FROM       "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":top;
   CHARACTERIZED BY
      "Recommendation M.3100 [5] : 1992":stateChangeNotificationPackage,
      pnoSNCBidirectionalPerformanceMonitorPackage;
REGISTERED AS {xatmObjectClass 17};
```

6.7 Package Definitions

```
pnoLCBidirectionalPerformanceMonitorPackage PACKAGE
   BEHAVIOUR
      pnoLCBirectionalPerformanceMonitorBeh BEHAVIOUR
         DEFINED AS
            " This object class represents the monitor for measuring the performance
            of a 'link connection'. One or two objects of this MOC will be created as
            a side effect of the reservePnoVpSubnetworkConnection ACTION when that
            action is received by a pnoVpSubnetwork MANAGED OBJECT. However the
            creation will only be carried out if Performance Management is supported.
            In case of a T-PNO two objects of this object class will be created. The
            created objects will be contained in a pnoVpSubnetworkConnection object
            instance. One object represents the LinkConnection in direction of the
            A-PNO (aEnd) and the other object represents the LinkConnection in
            direction of the Z-PNO (zEnd). The information to which direction the
            pnoLCBidirectionalPerformanceMonitor belongs will be kept in the ATTRIBUTE
            locationId. Only one instance of this object class will be created in case
            of a A- or Z-PNO.
            This object class contains the pnoLCControlPM ACTION to start and stop the
            measurement.
            An object of this MOC will be deleted as a side effect of the
            releasePnoVpSubnetworkConnection ACTION when that action is received by
            the pnoVpSubnetwork MO. When a pnoLCControlPM ACTION is received with the
            meaning of starting the measurement, a pnoPerformanceData object is
            created and at least one of the attributes sinkPMRequest and
            sourcePMRequest will be set to TRUE. The Monitoring process will be
            started when additionally the AdministrativeState of the connection is
            unlocked. If the AdministrativeState is set to locked when the
            pnoLCControlPM ACTION has been received the Monitoring process will be
            started when AdministrativeState will be set to unlocked.
            If a pnoLCControlPM ACTION is received with the meaning of stopping the
            measurement the pnoPerformanceData object will be deleted and the
            attributes sinkPMRequest and sourcePMRequest will be set to FALSE.";;
```

```
   ATTRIBUTES
      locationId GET,
      "ITU-T Rec. I.751 [6] ":sinkPMMechanismActive GET,
      "ITU-T Rec. I.751 [6] ":sourcePMMechanismActive GET,
      "ITU-T Rec. I.751 [6] ":inAverageMonitoringBlockSize GET,
      "ITU-T Rec. I.751 [6] ":outAverageMonitoringBlockSize GET,
      sinkPMRequest GET,
      sourcePMRequest GET,
      "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":operationalState GET;
   ACTIONS
      pnoLCControlPM;
REGISTERED AS {xatmPackage 10};
pnoPerformanceDataPkg PACKAGE
   BEHAVIOUR
      pnoPerformanceDataBehaviour BEHAVIOUR
         DEFINED AS
            "Instances of this object class are created/deleted whenever a request to
            start or stop the performance monitoring is received from the I-PNO
            (controlPM ACTION).
            One instance is created per pnoSNCBidirectionalPerformanceMonitor or
            pnoLCBidirectionalPerformanceMonitor object instance associated to the
            monitored connection.
            Instances of this object class keep the current performance data in the
            attributes atoZCER, atoZCLR0, atoZCLR0+1, atoZCMR, atoZSECBR,
            atoZCTD, atoZCDV for the A to Z transmission and in the attributes
            ztoACER, ztoACLR0, ztoACLR0+1, ztoACMR, ztoASECBR, ztoACTD, ztoACDV for
            the Z to A transmission direction.
            If named by an instance of the pnoLCBidirectionalPerformanceMonitor object
            class, this instance keeps the current performance data for one
            VpLinkConnection (depending on the value of the locationId attribute of
            the object pnoLCBidirectionalPerformanceMonitor) for one only transmission
            direction.
            Attribute values for the other direction are set to NULL.
            If named by an instance of the pnoSNCBidirectionalPerformanceMonitor
            object class, performance data for both transmission directions can be
            held.
            In case that not every parameter is supported, the not supported
            attributes are set to NULL.
            Instances of this object class keep in the pnoGaugeThresholdAttributeList
            attribute the performance parameters associated to the requested QoS class
            for the reserved connection.
            It has to be distinguished between three cases:
            1) If the pnoPerformanceData MO is contained in a
            pnoSNCBidirectionalPerformanceMonitor:
            the information for the QoS class value is taken from the corresponding
            attribute in the pnoVpSubnetworkConnection object received in the
            reservePnoVpSubnetworkConnection ACTION. The threshold values are taken
            from the QoS table (SNC values).
            2) If the pnoPerformanceData MO is contained in a
            pnoLCBidirectionalPerformanceMonitor and the access point involved in the
            LinkConnection is related to the aEndNWTPList attribute the
            pnogaugeThresholdAttributeList values will be populated according to the
            Link sink QoS value from the information syntax of the pnoLCControlPM
            ACTION.
            3) If the pnoPerformanceData MO is contained in a
            pnoLCBidirectionalPerformanceMonitor and the access point involved in the
            LinkConnection is related to the zEndNWTPList attribute: the information
            for the QoS class value is taken from the corresponding attribute in the
            pnoVpSubnetworkConnection object received in the
            reservePnoVpSubnetworkConnection ACTION. The threshold values are taken
            from the QoS table (LC values).
            The current performance data will be compared with these threshold values
            to trigger the emission of a ' threshold crossing'
            qualityofServiceAlarm notification. These values are not visible on the
            X-interface and copied by the agent in the
            pnogaugeThresholdAttributeList from an internal table when the object
            instance is created.
            If an instance of this MOC is contained in an instance of the
            pnoSNCBidirectionalPerformanceMonitor MOC then threshold values for aToZ
            and zToA directions are set. If an instance of this MOC is contained in an
            instance of pnoLCBidirectionalPerformanceMonitor then threshold values
            only for one direction are set depending on the value of the location
            attribute of the object pnoLCBidirectionalPerformanceMonitor. This
            attribute is read only and can not be modified by the ThresholdSetting
            Management Function.
            The attribute additionalGaugeThresholdAttributeList may be used for
            defining additional thresholds. These thresholds can be modified by the
            I-PNO using the ThresholdSetting Management Function. The performance data
            may also be compared with this values to trigger additional 'threshold
            crossing'
            qualityofServiceAlarms notifications.
            The scanPeriod attribute indicates the time interval between two
            successive updates of performance parameters.
```

```
            The offsetTime attribute represents the difference between the current
            time and the time of the last update of the performance parameters.
            The unavailabilityState attribute indicates if the connection is in an
            unavailable or not.
            These 3 attributes are for reading only.
            Whenever the value of a performance parameter violates its threshold, a
            qualityofServiceAlarm notification is emitted with the probable cause
            'threshold crossed' and the perceived severity 'warning'. This emission is
            triggered by the reception of a notification from the intrA-PNO domain. A
            qualityofServiceAlarm notification is emitted with the probable cause
            'threshold crossed' and the perceived severity 'cleared' when the
            parameters threshold violation ends. The observedValue of a notification
            will be set to the threshold value of the appropriate performance
            attribute.
            Whenever an unavailability period starts, a qualityofServiceAlarm
            notification is emitted with the probable cause 'underlying resource
            unavailable' and the perceived severity 'warning'. This emission is
            triggered by the reception of a notification from the intrA-PNO domain.
            A qualityofServiceAlarm notification is emitted with the probable cause
            'underlying resource unavailable' and the perceived severity 'cleared'
            when the unavailability period ends."
      ;;
   ATTRIBUTES
      pnoPerformanceDataId GET,
      atoZCER GET,
      atoZCLR0 GET,
      atoZCLR0plus1 GET,
      atoZCMR GET,
      atoZSECBR GET,
      atoZCTD GET,
      atoZCDV GET,
      ztoACER GET,
      ztoACLR0 GET,
      ztoACLR0plus1 GET,
      ztoACMR GET,
      ztoASECBR GET,
      ztoACTD GET,
      ztoACDV GET,
      scanPeriod GET,
      offsetTime GET,
      pnoGaugeThresholdAttributeList GET,
      additionalGaugeThresholdAttributeList GET-REPLACE,
      unavailabilityState GET;
   NOTIFICATIONS
      "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":qualityofServiceAlarm;
REGISTERED AS {xatmPackage 11};
pnoSNCBidirectionalPerformanceMonitorPackage PACKAGE
   BEHAVIOUR
      pnoSNCBirectionalPerformanceMonitorBeh BEHAVIOUR
         DEFINED AS
            " This object class represents two sinks and two sources for measuring the
            performance of a pnoVpSubnetworkConnection. Physically one sink and one
            source belong to one pnoVPCTP. It will be created as a side effect of the
            reservePnoVpSubnetworkConnection ACTION when that action is received by a
            pnoVpSubnetwork MANAGED OBJECT . The creation will only be done if
            Performance Management is supported. This object class contains the
            pnoSNCControlPM ACTION to start and stop the measurement. An object of
            this MOC will be deleted when receiving a releasePnoVpSubnetworkConnection
            ACTION.
            When a pnoSNCControlPM ACTION is received with the meaning of starting the
            measurement, a pnoPerformanceData object is created and at least one of
            the attributes sinkPMRequest and sourcePMRequest will be set to TRUE. The
            Monitoring process will be started when additionally the
            AdministrativeState of the connection is unlocked. If the
            AdministrativeState is set to locked when the pnoSNCControlPM ACTION has
            been received the Monitoring process will be started when
            AdministrativeState will be set to unlocked.
            . An object of this MOC will be deleted as a side effect of the
            releasePnoVpSubnetworkConnection ACTION when that action is received by
            the pnoSubnetwork MO.";;
   ATTRIBUTES
      locationId GET,
      "ITU-T Rec. I.751 [6] ":sinkPMMechanismActive GET,
      "ITU-T Rec. I.751 [6] ":sourcePMMechanismActive GET,
      "ITU-T Rec. I.751 [6] ":inAverageMonitoringBlockSize GET,
      "ITU-T Rec. I.751 [6] ":outAverageMonitoringBlockSize GET,
      "ITU-T Recommendation X.721 [10]   | ISO/IEC 10165-2 [4] : 1992":operationalState GET,
      sinkPMRequest GET,
      sourcePMRequest GET;
   ACTIONS
      pnoSNCControlPM;
REGISTERED AS {xatmPackage 12};
```

6.8 Attribute Definitions

```
additionalGaugeThresholdAttributeList ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PNOGaugeThresholdAttributeList;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      additionalGaugeThresholdAttributeListBehaviour BEHAVIOUR
         DEFINED AS
            "This attribute is used for multiple thresholding. The values of the
            parameters (cer, clr0, clr0+1, cmr, secbr, ctd, cdv) are compared with the
            values contained in this attribute, too.
            If the value of one parameter is crossed a QoSAlarm notification is
            emitted. These thresholds can be modified by the I-PNO using the MF
            ThresholdSetting";;
REGISTERED AS {xatmAttribute 16};
additionalInformationAttribute ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.AdditionalInformationAttribute;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      additionalInformationAttributeBehaviour BEHAVIOUR
         DEFINED AS
            "The purpose of this attribute is to specify whether the QoSAlarm has been
            caused in a subNetwork or a linkConnection towards the aEnd or towards the
            zEnd.";;
REGISTERED AS {xatmAttribute 17};
atoZCDV ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCDVBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell delay variation
            value measured for the monitored entity for the A to Z transmission
            direction.";;
REGISTERED AS {xatmAttribute 18};
atoZCER ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCERBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell error ratio value
            measured for the monitored entity for the A to Z transmission direction.";;
REGISTERED AS {xatmAttribute 19};
atoZCLR0 ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCLR0Behaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell loss ratio value
            for cells with CellLossPriority = 0 measured for the monitored entity for
            the A to Z transmission direction.";;
REGISTERED AS {xatmAttribute 20};
atoZCLR0plus1 ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCLR0plus1Behaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell loss ratio value
            for cells with CellLossPriority = 0 and cells with CellLossPriority = 1
            measured for the monitored entity for the A to Z transmission direction.";;
REGISTERED AS {xatmAttribute 21};
atoZCMR ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCMRBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell misinsertion rate
            value measured for the monitored entity for the A to Z transmission
            direction.";;
REGISTERED AS {xatmAttribute 22};
atoZCTD ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZCTDBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell transfer delay
            value measured for the monitored entity for the A to Z transmission
```

```
            direction.";;
REGISTERED AS {xatmAttribute 23};
atoZSECBR ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      atoZSECBRBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current value measured of the
            severely errored cell blocks ratio for the monitored entity for the A to Z
            transmission direction.";;
REGISTERED AS {xatmAttribute 24};
locationId ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.LocationId;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      locationIdBehaviour BEHAVIOUR
         DEFINED AS
            "The locationId attribute is used as naming attribute for instances of
            pnoSNCBidirectionalPerformanceMonitor and
            pnoLCBidirectionalPerformanceMonitor whether the PerformanceMonitor is
            related to the subnetworkConnection (value of the attribute will be set to
            subnetworkConnection) or to the pnoVPCTP belonging to the link in
            direction towards the A-PNO (value of the attribute will be set to aEnd)
            or the pnoVPCTP belonging to the link in direction towards the Z-PNO
            (value of the attribute will be set to zEnd). All *PerformanceMonitor
            objects are named by pnoVpSubnetworkConnection.
            Depending on this attribute the agreed performance parameter values for
            aEnd or zEnd (values are contained in the table associated to the QoSClass
            (0..99)) will be put into the pnoGaugeThresholdAttributeList attribute of
            the pnoPerformanceData object when performance measurement is started.";;
REGISTERED AS {xatmAttribute 25};
offsetTime ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.ElapsedTime;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      offsetTimeBehaviour BEHAVIOUR
         DEFINED AS
            "This attribute represents the difference between the current time and the
            time of the last update of the performance parameters according to the
            ASN.1 definition of TimeInterval from ITU-T Q.821.";;
REGISTERED AS {xatmAttribute 26};
pnoGaugeThresholdAttributeList ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PNOGaugeThresholdAttributeList;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      pnoGaugeThresholdAttributeListBehaviour BEHAVIOUR
         DEFINED AS
            "This attribute keeps the agreed performance thresholds associated to the
            QoS of the connection requested in the reservation request. If the object
            this attribute belongs to is contained in an object of
            pnoSNCBidirectionalPerformanceMonitor then it contains threshold values
            for both aToZ and zToA directions. If an object of this MOC is contained
            in an object of pnoLCBidirectionalPerformanceMonitor then it contains
            threshold values only for one direction. The direction depends on the
            value of the location ATTRIBUTE of the object
            pnoLCBidirectionalPerformanceMonitor. The values of the current
            performance parameters (cer, clr0, clr0+1, cmr, secbr, ctd, cdv) are
            compared with the values contained in this attribute. If the value of one
            parameter is crossed a qualityofServiceAlarm notification is emitted. This
            attribute is for reading only on X-interface. It can only be modified
            by a 'Change Reservation' request from the I-PNO to get another QoS for
            the connection";;
REGISTERED AS {xatmAttribute 27};
pnoPerformanceDataId ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.SimpleNameType;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      pnoPerformanceDataIdBehaviour BEHAVIOUR
         DEFINED AS
            "This attribute is used as the RDN attribute for instances of the
            PerformanceData Object Class.";;
REGISTERED AS {xatmAttribute 28};
scanPeriod ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.TimePeriod;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      scanPeriodBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute indicates the time interval between two successive update
            of performance parameters according to the ASN.1 definition of
            TimeInterval from ITU-T Q.821.";;
REGISTERED AS {xatmAttribute 29};
```

```
sinkPMRequest ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.SinkPMRequest;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      sinkPMRequestBehaviour BEHAVIOUR
         DEFINED AS
            "The sinkPMRequest attribute indicates when the value is set to TRUE that
            the process of performance monitoring has been requested to start.
            The monitoring process starts when at minimum the sinkPMRequest or
            sourcePMRequest is set to TRUE and additionally the AdministrativeState of
            the connection is set to UNLOCKED.
            A source point is the ingress point for OAM cells and a sink point the
            egress point.";;
REGISTERED AS {xatmAttribute 30};
sourcePMRequest ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.SourcePMRequest;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      sourcePMRequestBehaviour BEHAVIOUR
         DEFINED AS
            "The sourcePMRequest attribute indicates when the value is set to TRUE
            that the process of performance monitoring has been requested to start.
            The monitoring process starts when at minimum the sinkPMRequest or
            sourcePMRequest is set to TRUE and additionally the AdministrativeState of
            the connection is set to UNLOCKED. A source point is the ingress point for
            OAM cells and a sink point the egress point.";;
REGISTERED AS {xatmAttribute 31};
unavailabilityState ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMUnavailabilityState;
   MATCHES FOR EQUALITY;
   BEHAVIOUR
      unavailabilityStateBehaviour;
REGISTERED AS {xatmAttribute 32};
ztoACDV ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACDVBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell delay variation
            value measured for the monitored entity for the Z to A transmission
            direction.";;
REGISTERED AS {xatmAttribute 33};
ztoACER ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACERBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell error ratio value
            measured for the monitored entity for the Z to A transmission direction.";;
REGISTERED AS {xatmAttribute 34};
ztoACLR0 ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACLR0Behaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell loss ratio value
            for cells with CellLossPriority = 0 measured for the monitored entity for
            the Z to A transmission direction.";;
REGISTERED AS {xatmAttribute 35};
ztoACLR0plus1 ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACLR0plus1Behaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell loss ratio value
            for cells with CellLossPriority = 0 and cells with CellLossPriority = 1
            measured for the monitored entity for the Z to A transmission direction.";;
REGISTERED AS {xatmAttribute 36};
ztoACMR ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACMRBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell misinsertion rate
            value measured for the monitored entity for the Z to A transmission
            direction.";;
REGISTERED AS {xatmAttribute 37};
ztoACTD ATTRIBUTE
```

```
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoACTDBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current cell transfer delay
            value measured for the monitored entity for the Z to A transmission
            direction.";;
REGISTERED AS {xatmAttribute 38};
ztoASECBR ATTRIBUTE
   WITH ATTRIBUTE SYNTAX    XATMPMModule.PMParameter;
   MATCHES FOR EQUALITY, ORDERING;
   BEHAVIOUR
      ztoASECBRBehaviour BEHAVIOUR
         DEFINED AS
            " This attribute of Gauge Type contains the current value measured of the
            severely errored cell blocks ratio for the monitored entity for the Z to A
            transmission direction.";;
REGISTERED AS {xatmAttribute 39};
```

6.9 Action Definitions

```
pnoLCControlPM ACTION
   BEHAVIOUR
      pnoLCControlPMBeh;
   MODE CONFIRMED;
   WITH INFORMATION SYNTAX XATMPMModule.PnoLCControlPMInformation;
   WITH REPLY SYNTAX XATMPMModule.PnoLCControlPMResult;
REGISTERED AS {xatmAction 12};
pnoSNCControlPM ACTION
   BEHAVIOUR
      pnoSNCControlPMBeh;
   MODE CONFIRMED;
   WITH INFORMATION SYNTAX XATMPMModule.PnoSNCControlPMInformation;
   WITH REPLY SYNTAX XATMPMModule.PnoSNCControlPMResult;
REGISTERED AS {xatmAction 13};
```

6.10 Name Binding Definitions

```
pnoLCBidirectionalPerformanceMonitor-pnoVpSubnetworkConnection NAME BINDING
   SUBORDINATE OBJECT CLASS pnoLCBidirectionalPerformanceMonitor;
   NAMED BY SUPERIOR OBJECT CLASS "P708_CM_FM_master":pnoVpSubnetworkConnection;
   WITH ATTRIBUTE locationId;
   BEHAVIOUR
      pnoLCBidirectPerfMonitor-pnoVpSubnetworkConnectionBehaviour;
REGISTERED AS {xatmNameBinding 17};
pnoPerformanceDatA-PNOLCBidirectionalPerformanceMonitor NAME BINDING
   SUBORDINATE OBJECT CLASS pnoPerformanceData AND SUBCLASSES;
   NAMED BY SUPERIOR OBJECT CLASS pnoLCBidirectionalPerformanceMonitor AND SUBCLASSES;
   WITH ATTRIBUTE pnoPerformanceDataId;
   BEHAVIOUR
      pnoPerformanceDatA-PNOLCBidirectionalPerformanceMonitorBehaviour;
   CREATE;
   DELETE ;
REGISTERED AS {xatmNameBinding 18};
pnoPerformanceDatA-PNOSNCBidirectionalPerformanceMonitor NAME BINDING
   SUBORDINATE OBJECT CLASS pnoPerformanceData AND SUBCLASSES;
   NAMED BY SUPERIOR OBJECT CLASS pnoSNCBidirectionalPerformanceMonitor AND SUBCLASSES;
   WITH ATTRIBUTE pnoPerformanceDataId;
   BEHAVIOUR
      pnoPerformanceDatA-PNOSNCBidirectionalPerformanceMonitorBehaviour;
   CREATE;
   DELETE ;
REGISTERED AS {xatmNameBinding 19};
pnoSNCBidirectionalPerformanceMonitor-pnoVpSubnetworkConnection NAME BINDING
   SUBORDINATE OBJECT CLASS pnoSNCBidirectionalPerformanceMonitor;
   NAMED BY SUPERIOR OBJECT CLASS "P708_CM_FM_master":pnoVpSubnetworkConnection;
   WITH ATTRIBUTE locationId;
   BEHAVIOUR
      pnoSNCBidirectPerfMonitor-pnoVpSubnetworkConnectionBeh;
REGISTERED AS {xatmNameBinding 20};
pnoLCBidirectPerfMonitor-pnoVpSubnetworkConnectionBehaviour BEHAVIOUR
   DEFINED AS
      "A pnoLCBidirectionalPerformanceMonitor object instance is created when the
      pnoSubnetwork object receives a reservePnoVpSubnetworkConnection action and
      Performance Monitoring is requested. Depending on the role of the receiving PNO
      (A/T/Z-
      PNO) one or two objects of the objectclass pnoLCBidirectionalPerformanceMonitor
      will be created (two objects for a T-PNO or one object for the other cases). An
      object instance of the MOC pnoLCBidirectionalPerformanceMonitor is deleted by
      the action releasePnoVpSubnetworkConnection.";
```

6.11 Behaviour Definitions

```
pnoLCControlPMBeh BEHAVIOUR
   DEFINED AS
       "This action is used to request both the start and the stop of the Performance
      Monitoring OAM cell generation and processing procedures at the termination
      point upon which the performance monitoring function is performed within the
      link connections. It can also be used to request a different block size when the
      connection is not active (i.e.administrative state is locked). The attributes
      sinkPMRequest and sourcePMRequest will determine the role of each of involved
access points. Whenever the monitoring process is requested to start or stop, the
      attributes sinkPMRequest and/or sourcePMRequest contained in the
pnoLCBidirectionalPerformanceMonitor will have to be set to indicate it. The
      sinks have to be activated before the sources. When the performance monitoring
      is requested, a pnoPerformanceData object will be created. If the access point
      involved in the link connection is related to the aEndNWTPList attribute and the
      sinkPMRequest attribute indicates that performance monitoring is requested, its
      pnoGaugeThresholdAttributeList will be populated with values according to the
      attribute linkSinkQoS contained in the information syntax of the action. If the
      access point involved is related with the zEndNWTPList attribute and the
      sinkPMRequest attribute indicates that performance monitoring is requested, its
      pnoGaugeThresholdAttributeList will be populated with the values requested at
      reservation time associated to the QoS. When the connection is active and a
      request to change block size is received the block size is not changed. In this
      case an ACTION reply will be sent containing the previous block size."
;
pnoPerformanceDatA-PNOLCBidirectionalPerformanceMonitorBehaviour BEHAVIOUR
   DEFINED AS
      "A pnoPerformanceData object instance named by a
      pnoLCBidirectionalPerformanceMonitor object instance is created by the
      pnoLCControlPM ACTION when this action is used to start the performance
      monitoring. It is deleted by the controlPM ACTION when this action is used to
      stop the performance monitoring. It stores the measured performance data for one
      LinkConnection between two PNOs for one only transmission direction.";
pnoPerformanceDatA-PNOSNCBidirectionalPerformanceMonitorBehaviour BEHAVIOUR
   DEFINED AS
      "A pnoPerformanceData object instance named by a
      pnoSNCBidirectionalPerformanceMonitor object instance is created by the
      pnoSNCControlPM ACTION when this action is used to start the performance
      monitoring. It is deleted by the controlPM ACTION when this action is used to
      stop the performance monitoring. It stores the measured performance data for one
      subnetwork connection for both transmission directions.";
pnoSNCBidirectPerfMonitor-pnoVpSubnetworkConnectionBeh BEHAVIOUR
   DEFINED AS
      "An instance of the pnoSNCBidirectionalPerformanceMonitor object is created when
      the pnoSubnetwork object receives a reservePnoVpSubnetworkConnection action and
      Performance Monitoring is requested. An object instance of this MOC is deleted
      by the action releasePnoVpSubnetworkConnection. ";
pnoSNCControlPMBeh BEHAVIOUR
   DEFINED AS
      "This action is used to request both the start and the stop of the Performance
      Monitoring OAM cell generation and processing procedures at the termination
      point upon which the performance monitoring function is performed within the
      subnetwork connections. It can also be used to request a different block size
      when the connection is not active (i.e.administrative state is locked).
      The attributes sinkPMRequest and sourcePMRequest will determine the role of the
      access point related with the aEndNWTPList attribute and the access point at the
      other end of the subnetwork connection will necessarily take the opposite role.
      Whenever the monitoring process is requested to start or stop, the attributes
      sinkPMRequest and/or sourcePMRequest contained in the
      pnoSNCBidirectionalPerformanceMonitor will have to indicate it. The sinks have
      to be activated before the sources. When the performance monitoring is
      requested, a pnoPerformanceData object will be created and its
      pnoGaugeThresholdAttributeList will be populated with the values requested at
      reservation time associated to the QoS. When the connection is active and a
      request to change block size is received the block size is not changed. In this
      case an ACTION reply will be sent containing the previous block size.";
unavailabilityStateBehaviour BEHAVIOUR
   DEFINED AS
      "This attribute indicates if the connection is in an unavailable state or not.
      The value of this attribute is changed whenever a notification indicating the
      start or the end of the unavailability period is received from the ODMS. The
      start of the unavailability period message is sent after 10 Severely Errored
      Seconds (SES) have occurred and have been detected at the ODMS level by the OAM
      flow continuity check. The end of unavailability period message is sent after 10
      non SES seconds.";
```

6.12 ASN.1 Module

```
XATMPMModule {ccitt(0) identified-organization (4) etsi (0) en300820-3 (820) informationModel (0)
asn1Module (2) asn1TypesModule (0)}
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
IMPORTS

AttributeId
FROM
CMIP-1 {joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3)}

SimpleNameType
FROM
Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1}

GaugeThresholdAttributeList, ElapsedTime
FROM
Q822-PM-ASN1Module {ccitt(0) recommendation(0) q(17) q822(822)
 asn1Module(2) q822ASN1Module(0)}

TimePeriod
FROM
MetricModule {joint-iso-ccitt ms(9) function(2) part11(11) asn1Module(2) 0}

AverageMonitoringBlockSize, PMProblem
FROM
AtmMIBMod {itu-t(0) recommendation(0) i(9) atmm(751)
informationModel(0) asn1Module(2) atm(0)}

VpQoSClass
FROM
ASN1XatmModule { ccitt(0) identified-organization(4) etsi(0) xcoop(1996)
informationModel(0) asn1Module(2) asn1TypesModule(0) };

xatmInfoModel OBJECT IDENTIFIER ::= {ccitt(0) identified-organization(4) etsi(0) p708(708)
informationModel(0) }

xatmObjectClass OBJECT IDENTIFIER::= {xatmInfoModel managedObjectClass(3) }

xatmPackage OBJECT IDENTIFIER::= { xatmInfoModel package(4) }

xatmNameBinding OBJECT IDENTIFIER::= { xatmInfoModel nameBinding(6) }

xatmAttribute OBJECT IDENTIFIER::= { xatmInfoModel attribute(7) }

xatmAction OBJECT IDENTIFIER::= {xatmInfoModel action(9) }

xatmNotification OBJECT IDENTIFIER::= { xatmInfoModel notification(10) }

LocationId ::=  ENUMERATED {aEnd (0), zEnd (1), subnetworkConnection (2)}

PnoLCControlPMInformation::= SEQUENCE{
    controlSourcePMRequest [0]      SourcePMRequest OPTIONAL,
    controlSinkPMRequest [1]        SinkPMRequest OPTIONAL,
    linkSinkQoS [2]         LinkSinkQoS OPTIONAL }

PnoLCControlPMResult::= SEQUENCE{
    sourcePMRequestResult [0]       SourcePMRequest OPTIONAL,
    sinkPMRequestResult [1]     SinkPMRequest OPTIONAL,
    additionalInformation           SET OF PMProblem OPTIONAL}

SourcePMRequest::=SEQUENCE{
    sourcePMRequestStatus           BOOLEAN,
    sourceAverageMonitoringBlockSize    AverageMonitoringBlockSize  OPTIONAL}

SinkPMRequest::=SEQUENCE{
    sinkPMRequestStatus     BOOLEAN,
    sinkAverageMonitoringBlockSize  AverageMonitoringBlockSize  OPTIONAL}

LinkSinkQoS::= VpQoSClass

PNOGaugeThresholdAttributeList ::= GaugeThresholdAttributeList

-- NOTE:  For the experiment the following syntax was used but as a result of validation, the
 -- above simpler syntax was agreed to be better:
--PNOGaugeThresholdAttributeList ::= SEQUENCE {
--   aToZPNOGaugeThresholdAttributeList GaugeThresholdAttributeList,
--   zToAPNOGaugeThresholdAttributeList GaugeThresholdAttributeList}


PnoSNCControlPMInformation::= SEQUENCE{
```

```
    controlSourcePMRequest [0]      SourcePMRequest OPTIONAL,
    controlSinkPMRequest [1]        SinkPMRequest OPTIONAL}

PnoSNCControlPMResult::= SEQUENCE{
    sourcePMRequestResult [0]       SourcePMRequest OPTIONAL,
    sinkPMRequestResult [1]         SinkPMRequest OPTIONAL,
    additionalInformation           SET OF PMProblem OPTIONAL}

PMParameter ::= CHOICE {
        null                    NULL,
        value       REAL}

PMUnavailabilityState ::= ENUMERATED {available(0), unavailable(1)}

AdditionalInformationAttribute ::= ENUMERATED {
                        subNetworkConnection        (0),
                        aSideLinkConnection     (1),
                        zSideLinkConnection     (2)}

END -- of XATMPMModule
```

Annex A (informative): Need for enhancing the QoS Table

It is possible to agree in the VP setup requests a certain Quality of Service. In the request this parameter is represented by an INTEGER value (0..99). Since a certain Quality of Service is described by various performance parameters ITU-T Recommendation I.356 [2] , a QoS Table should be agreed between the PNOs communicating via X-interface. These INTEGER value should represent the performance parameters values of assumed connections of QoS classes.

The QoS Table should looks like the following table:

Table A.1: QoS values.

	CLR		**CTD**		**CMR**		**further performance parameters.**	
	SNC	LC	SNC	LC	SNC	LC	SNC	LC
1								
2								
3								
4								
etc								

In order to get information about the requested performance parameters the QoS Table has to be enhanced. Otherwise, for example, a T-PNO would not know the values of these parameters belonging to the link in direction towards the A-PNO. In order to measure and control the link connection the T-PNO has to know these values because one sink of the measurement (flow direction a to z) will be in the T-PNO. So the threshold values must be set at the T-PNO. Therefore the information of the agreed performance parameter values is needed here.

Annex B (informative): Mapping of messages onto CMIP primitives

The table B.1 shows name, description and corresponding CMIP primitive for the messages across the X-interface.

Table B.1: Mapping of MFs into CMIP primitives

Message	Description	CMIP Primitive
ReadPerformanceDataMF (Request)	request to Read Performance Data from another PNOs (A, T, Z) by the I-PNO.	GET Request
ReadPerformanceDataMF(Response)	Performance Data current values sent back in response	GET Response
Unavailable Time Notification MF	Message indicating the beginning or the end of an unavailable period for a VPC.	Event-Report
Threshold Crossed Notification MF	Message indicating the cross of a threshold by a parameter of a monitored VPC.	Event-Report
Performance Log Inspection MF (Request)	Request sent by the I-PNO to a PNO (A, T, Z) to read perfLog data related to VPC of which the I-PNO is responsible for.	GET Request
Performance Log Inspection MF (Response)	PerfLog inspection response	GET Response
PM Additional Thresholds Setting/Modification MF (Request)	Request by the I-PNO to set/modify additional thresholds for performance parameters	SET Request
PM Additional Thresholds Setting/Modification MF (Response)	Response to the I-PNO for the setting/modification of additional thresholds.	SET Response
Start/Stop PM on a Subnetwork Connection MF (Request)	Request by the I-PNO to start/stop the performance monitoring on a Subnetwork Connection	ACTION Request
Start/Stop PM on a Subnetwork Connection MF (Response)	Response to the I-PNO to start/stop the performance monitoring on a Subnetwork Connection.	ACTION Response
Start/Stop PM on a Link Connection MF (Request)	Request by the I-PNO to start/stop the performance monitoring on a Link Connection	ACTION Request
Start/Stop PM on a Link Connection MF (Response)	Response to the I-PNO to start/stop the performance monitoring on a Link Connection	ACTION Response

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

Network Management Forum: Forum 025, The "Ensemble" Concepts and Format, Issue 1.0, August 1992.

ITU-T Recommendation M.3020: "TMN Interface Specification Methodology".

ITU-T Recommendation G.805: "Generic Functional Architecture of Transport Networks".

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

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

ISO/IEC ISP 11183-3 (1992(E)): "CMISE/ROSE for AOM11 - Basic Management Communications".

ISO/IEC ISP 11183-2 (1992(E)): "CMISE/ROSE for AOM12 - Enhanced Management Communications".

History

Document history			
V0.1.3	February 2000	Public Enquiry	PE 200023: 2000-02-09 to 2000-06-09