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European Standard (Telecommunications series)

Telecommunications Management Network (TMN); Management information model for the X-type interface between Operation Systems (OSs) of a Virtual Path/ Virtual Channel (VP/VC) cross connected network; Part 2: Fault management

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Contents

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Foreword

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

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document addresses the requirements of network and service providers of Asynchronous Transfer Mode (ATM) crossconnected networks for managing the faults associated with the Virtual Path/Virtual Channel (VP/VC) 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 Network Operators (NOs).

The present document describes the Fault Management (FM) area, covering the following aspects:

- the management services and functions needed for fault management of ATM Connections which span several administrative domains. These management services and functions cover the requirements for the X interface in terms of fault management.

- the management information crossing the X interface. This management information specification uses the GDMO formalism, described in ITU-T Recommendation X.722 [10].

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case 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] TCR-TR 014 (1993): "Transmission and Multiplexing (TM); Harmonization of transport network architecture and protocol reference model for the transport of Asynchronous Transfer Mode (ATM) cells".

[2] ITU Recommendation M.3400: "Maintenance: Telecommunications Management Network".

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

[4] CCITT Recommendation M.3010: "Principles for a Telecommunications Management Network".

[5] CCITT Recommendation M.3100: "Generic Network Information Model".

[6] CCITT Recommendation Q.822: "Stage 2 and stage 3 description for the Q3 interface-performance monitoring".

[7] CCITT Recommendation Q.821: "Stage 2 and stage 3 description for the Q3 interface-alarm surveillance".

[8] CCITT Recommendation X.720: "Management Information Model".

[9] CCITT Recommendation X.721: "Definition of Management Information".

[10] ITU-T Recommendation X.722: "Guidelines for the definition of managed objects for CCITT applications".

[11] CCITT Recommendation X.208: "Specification of Abstract Syntax Notation One".

[12] CCITT Recommendation Q.811: "Q3 Lower layers Protocols".

[13] CCITT Recommendation Q.812: "Q3 Higher layers Protocols".

[14] CCITT Recommendation G.774: "Transmission and multiplexing SDH Information Model for the Network Element view".

[15] ETS 300 371 (1996): "Transmission and Multiplexing (TM); Plesiochronous Digital Hierarchy (PDH) information model for the Network Element (NE) view".

[16] CCITT Recommendation M.3020: "TMN Interface Specification Methodology".

[17] CCITT Recommendation I.371: "".

[18] CCITT Recommendation I.356: "B-ISDN ATM Layer Cell Transfer Performance".

[19] CCITT Recommendation I.35: "BA B-ISDN Semi-permanent Connection Availability".

[20] ITU T Recommendation X.733: "Information Technology - Open Systems Interconnection - Systems Management: Alarm Reporting".

3 Definitions

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

link: A "topological component" which describes the fixed relationship between a "sub-network" and another "sub-network" or "access group".

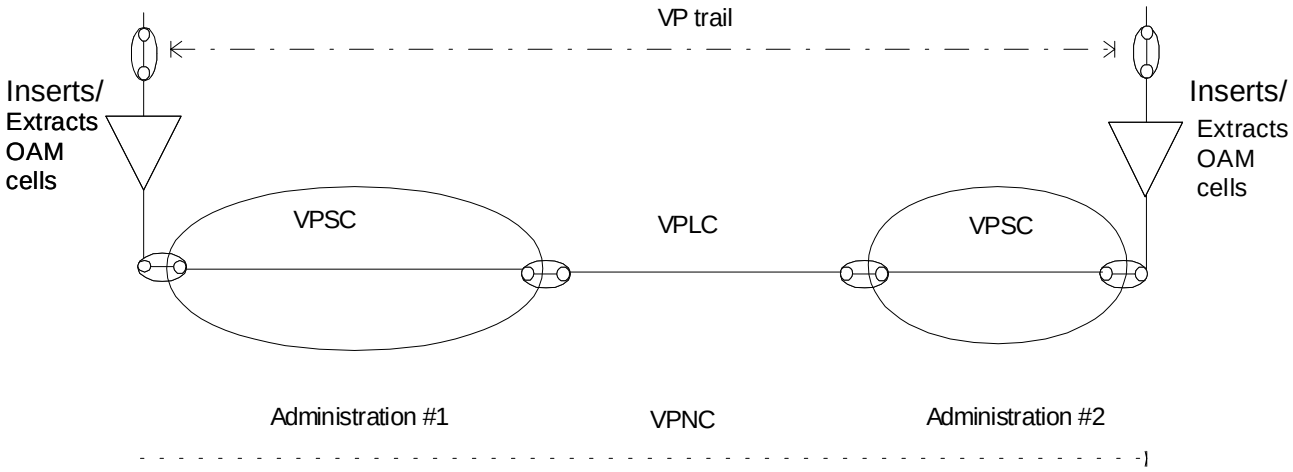
sub-network: A "topological component" used to effect routeing and management. It describes the potential for "sub-network connections" across the "sub-network". It can be partitioned into interconnected "sub-networks" and "links". Each " sub-network" in turn can be partitioned into smaller "sub-networks " and "links" and so on. A "sub-network" may be contained within one physical node.

connection: A "transport entity" which is capable of transferring information transparently between "connection points". A "connection" defines the association between the "connection points" and the "connection points" delimit the "connection".

link connection: A "transport entity" provided by the "client/server" association. It is formed by a near-end "adaptation" function, a server "trail" and a far-end "adaptation" function between "connection points". It can be configured as part of the "trail management process" in the associated server layer.

network connection: A "transport entity" formed by the series of "connections" between "termination connection points".

sub-network connection: A "transport entity" formed by a "connection" across a "sub-network" between "connection points". It can be configured as part of the "trail management process".



VPLC: VP Link Connection
VPNC: VP Network Connection
VPSC: VPSub Network Connection

Figure 1: Functional architecture of a VPC provided by two administrations

Initiating Public Network Operator (PNO): The Initiating PNO is the PNO requesting for a particular ATM connection starting in the sub-network of the Originator; The Initiating PNO and Originator might be the same PNO, but this is not necessary.

Originator PNO: The Originator PNO is the PNO connected to the originating client and controlling the VP/VC Connection. It is the Consumer of other PNO's parts of the VP/VC connection. It corresponds to the root of the X-interface tree.

Transit PNO: A Transit PNO is a PNO using its own sub-network and possibly other sub-networks of other PNOs to perform its required transit part of VP/VC connection. It can be both a Provider (where it acts as a Transit) and a Consumer (where it virtually acts as a Originator); then it corresponds to a branching node in the X-interface tree. It can also just be a Provider; then, it corresponds to a leaf in the X-interface tree, not being the Destination.

Destination PNO: A Destination PNO is a PNO assumed to be connected to the destination client, but which might use other sub-networks of other PNOs to reach the destination client. It can be both a Provider (where it acts as a Destination) and a Consumer (where it virtually acts as a Originator); then, it corresponds to a branching node on the direct path between Originator and Destination in the X-interface tree (NOTE: this the same for a Transit PNO). It can also just be a Provider; then, it corresponds to the rightmost leaf in the X-interface tree and is connecting the destination customer to the connection.

sub-network view: A sub-network view is a subtree of the X-interface tree. A sub-network view belongs to a particular PNO: the PNO at the root of the subtree.

Consumer and provider roles of a PNO: With respect to a particular VP/VCC, a Consumer PNO is a PNO that has delegated the management of a VP/VCSC plus the outgoing link connection (both shall be part of the connection) to another PNO (being a Provider PNO). A PNO can have both roles at once, if it is providing part of the VP/VCC (being a Provider), and at the same time asks another PNO to provide a part of the connection (being a Consumer).

X-interface tree: With respect to a particular VP/VCC, X-interface relations exist between each Provider PNO and their Consumer PNO. Because each Provider has exactly one Consumer, the X-interface relations between all PNOs involved in the management of a particular VP/VCC form a tree, the X-interface relation tree. Note that for a particular VP/VCC there can be several possible X-interface relation trees; the actual tree is formed at VP/VCC setup. The root of the tree is the Originator PNO; it uses (and via an X-interface controls) the PNOs (often Transit PNOs), to which it is connected in the tree via its branches. The most right leaf of the tree is the Destination PNO.

4 Requirements

F1 In case of faults, it should be possible to localize faults on a PNO sub-network level.

F2 All parties which are affected by a faulty PNO sub-network are to be informed on the repair status.

F3 All fault information passed across the interface should be time-stamped. Logging of faults and interrogation of logs across the X-interface is for further study.

F4 Either scheduled or on-demand reports of policing (tagging, discarding, violations etc.) should be available.

F5 Correlated physical and ATM connection alarms and performance data should be made available. It will be required to detect and eliminate redundant multiple alarms relating to a single underlying cause.

F6 Protection switching notification. Events leading to the activation of protection switching should be notified, as should the result of the protection. [ATMF]

F7 Connection continuity check. It should be possible to request continuity checks for connection segments as well as whole connections. [ATMF]

F8 It should be possible to request that test routines be performed for connection segments as well as whole connections.

F9 It shall be possible to enable/disable fault and performance reporting on a given connection or group of connections.

F10 It shall be possible to modify the filtering criteria for fault and performance reporting.

4 Management services

4.1 The basis for the exchange of management information

The architectural framework characterizing the exchange of management information across the Xcoop interface is represented in figure 2:

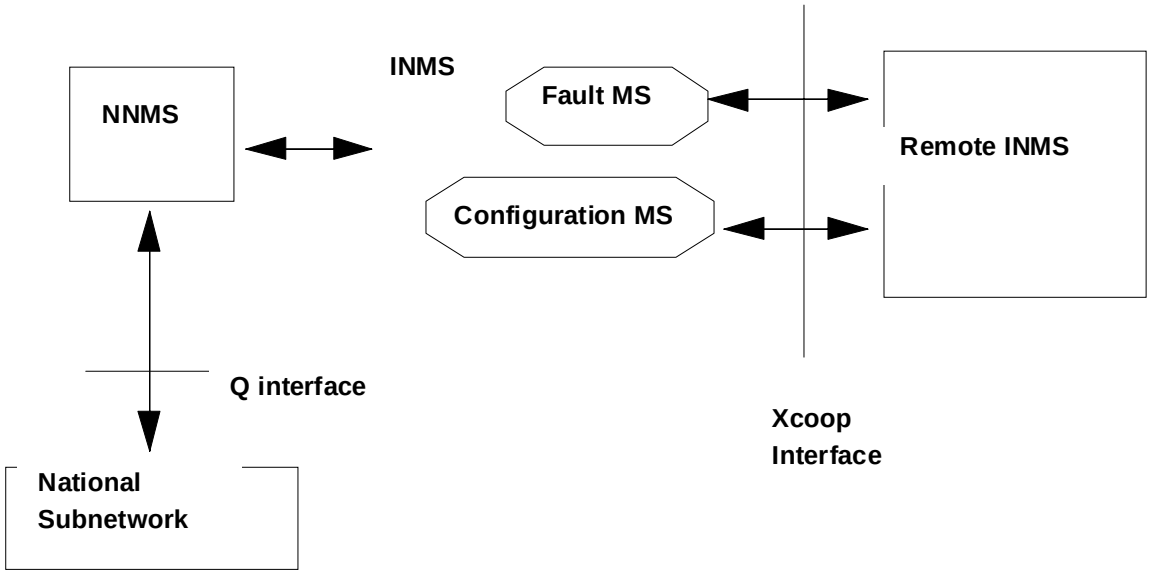


Figure 2 : Architectural framework for the Xcoop interface.

The block named National Network Management System (NNMS) is responsible for the management of the national sub-network while the block named International Network Management System (INMS) is responsible for the management of international connections using the national network. The distinction has been made because these two systems act on different Information Models and because there is the necessity of exchange of information between them. The logical positioning of the "Q" interface, which would basically control network switches in the NNMS, is also indicated but any matters relating to this interface are outside the scope of the present document.

The INMS has to support the following operations as far as Fault MS is concerned:

- reception of notifications coming from a remote INMS. These notifications are described in detail in 6.1.2.1
- reception of alarms coming from the NNMS and relevant to the Xcoop interface. These alarms may regard faulty VP connections used for international connections (they may be Physical Layer alarms or VP Layer alarms) or faults affecting the ATM Cross Connect which acts as the international gateway;
- elaboration of alarms coming from the NNMS (qualification and adaptation to international alarm format)
- sending of alarms to the appropriate Network Operators (NOs) (Origin NO in case of VPSC fault or all NOs in case of Inter-PNO Physical Link (IPPL) fault).
- logging alarms and retrieving alarm reports.

4.2 Resources

4.2.1 Notifications of the Fault Management

The following types of notifications are exchanged for the Fault Management service between the involved NOs:

- Notification of VPSC protection switching:

This notification is emitted by the affected NO when a successful protection switching event has been detected (Protection switching refers to the automatic activation of spare or back-up network resources available to the managing TMN). The protection switching procedure is performed upon protected resources. The notification is emitted towards the Origin NO by the **pnoVpSub-networkConnection** object.

- Notification of IPPL protection switching:

Each IPPL will have a "responsible" NO which is in charge of the fault management of the physical link. The responsible NO will be one of the two, the networks of which are connected by the link. The responsibility for a given link is assumed to have been agreed between the two NOs concerned before the service starts. This notification is emitted by the responsible NO when a successful protection switching event has been detected. The protection switching procedure is performed upon protected resources. The primitive is emitted towards every NO by the **pnoNWAtmAccessPoint** object .

- Notification of VPSC unrecoverable:

The VPSC Unrecoverable Notification is sent in case a fault is detected in the sub-network and there is no recovery procedure to clear it or this procedure fails. This notification is sent by the **pnoVpSub-networkConnection** object to the Origin NO which might decide to interrupt the service.

- Notification of IPPL unrecoverable

The IPPL Unrecoverable Notification is sent in case a fault is detected in the Inter-PNO Physical Link and there is no Recovery procedure to clear it or this procedure fails. This notification is sent by the **pnoNWAtmAccessPoint** object to every NO which must update its topology information.

- Notification of VPSC Under Recovery- VPSC recovery result:

These notifications are emitted sequentially by the NO which owns the VPSC affected by a defect towards the Origin NO.

The VPSC Under Recovery Notification is sent in case a fault is detected in the sub-network and there is a certain Recovery procedure that will provide a result (cleared or unrecoverable) in a short time.

When the Recovery procedure is completed, a VPSC Recovery Result Notification is sent. If VPSC Recovery Result is "unrecoverable" then the Origin NO might decide, or be forced, to interrupt the service. (figure 7.2.1 shows the logical procedure for "later manual recovery" if the service is interrupted, but this is not a Telecommunications Management (TMN) procedure and, accordingly, testing of such a situation is not specified in P408 D6, annex 3. The procedure for consequent clearing of alarms and updating of resource databases after manual recovery is also unspecified and remains a subject for further work).

These two notifications are sent by the **pnoVpSub-networkConnection** object to the Origin NO.

- Notification of ippl under recovery - ippl recovery result

Each IPPL will have a "responsible" NO which is in charge of the fault management of the physical link. The responsible NO will emit the IPPL Under Recovery Notification to every NO. This is due to the fact that several connections could be supported by the physical link and therefore every NO has to be informed about the recovery in action, at least for updating network topology or for avoiding the link under recovery. When the recovery procedure is completed, an IPPL Recovery Result Notification is sent. These two notifications are sent by the **pnoNWAtmAccessPoint** object to all the NOs. The same situation applies for later manual recovery of IPPLs as for VPSCs as discussed above.

4.2.2 Managed objects

For the purpose of defining FM functions the necessary resources are defined as follows:

- **pnoVpSub-networkConnection:** It represents a VP connection across a NO sub-network. This connection is seen by the Origin NO as a whole, with no details regarding the way the connection is composed inside the NO domain.

- **pnoNWAtmAccessPoint:** It represents the access point to the ATM NO Sub-network, or in other words, it represents an endpoint of a physical link at the cell level between two NOs. Each IPPL is terminated by two pnoNWAtmAccessPoints which are in charge of emitting Fault Notifications when detecting failures related to the link or to the access point itself.

- **Log:** Described in CCITT Recommendation X.721 [9]. There are three logs in the Fault Management system. RALog records the events received, SALog records the events sent and QALog stores information about qualified alarms. Only SALog is Xcoop visible to allow the other NOs to consult the events sent by the affected NO.

- **EFD:** Described in CCITT Recommendation X.721 [9]. It is not Xcoop visible but it is needed to send the events through the X interface.

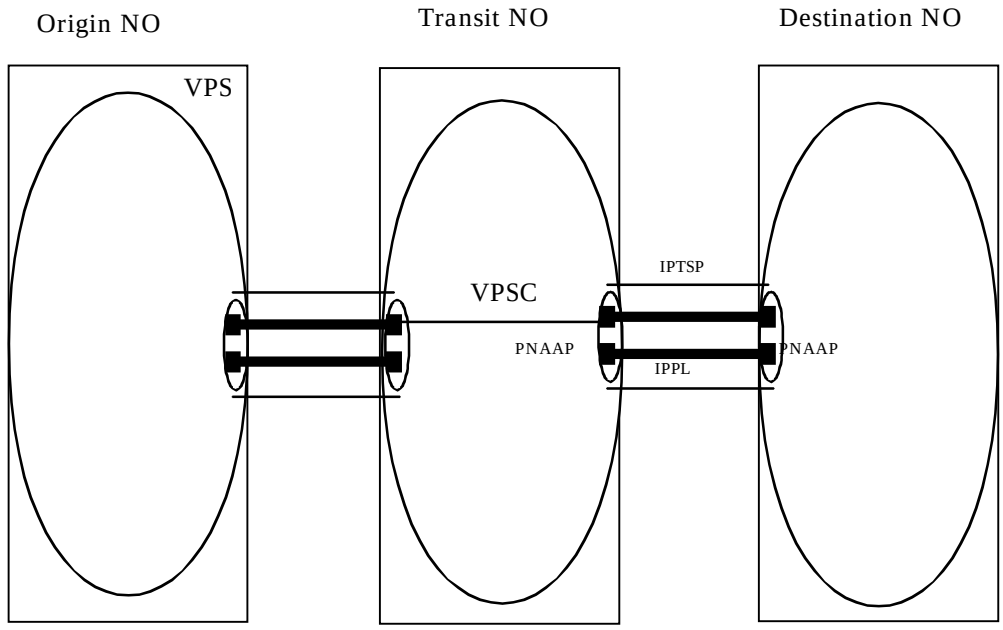
- **alarmRecord:** Described in CCITT Recommendation X.721 [9] for alarm event logging.

- **objectCreationRecord:** Described in CCITT Recommendation X.721 [9] for logging created objects.

- **objectDeletionRecord:** Described in CCITT Recommendation X.721 [9] for logging deleted objects.

- **stateChangeRecord:** Described in CCITT Recommendation X.721 [9] for logging changes of state attributes.

- **attributeValueChangeRecord:** Described in CCITT Recommendation X.721 [9] for logging changes of attributes values.



Legenda:

VPS: VP Sub-network
VPSC: VP Sub-network Connection
IPTSP: Inter-PNO Topological Sub-network Pair
IPPL: Inter-PNO Physical Link
PNAAP: pnoNWatmAccessPoint

Figure 3: Xcoop Interface Fault Management Resources

4.2.3 Notification parameters

It should also be noted that the notifications listed above and tabulated in subclauses 2.3.1 - 2.3.3 contain sets of requests and parameters. Three of the most important parameters of those notifications are "probableCause", "specificProblems" and "perceivedSeverity". These are derived from the event information section of ITTU Recommendation X.733 [20] and are reproduced here in order to clarify the basis on which the MF messages are generated by the system:

1) probableCause

This parameter defines further qualification (after Event Type and information) as to the probable cause of the alarm. Probable cause values for notifications shall be indicated in the behaviour clause of the object class definition. The syntax of standard probableCauses shall be the ASN.1 type object identifier. The managed object class designer should choose the most specific probableCause applicable.

There are 57 probableCauses standardized. These will not be further elaborated here and reference should be made to ITU Recommendation X.733.[20].

2) specificProblems

This parameter identifies the status of the alarm in the Fault Management. In the context of the FM specifications, the specificProblems values have been restricted to:

- protection-switched;

- under-recovery;

- cleared;

- unrecoverable;

3) perceivedSeverity

This parameter defines six severity levels, which provide an indication of how it is perceived that the capability of the managed object has been affected. Briefly, these are:

cleared:	indicates the clearing of one or more previously reported alarms;
indeterminate:	indicates that the severity level cannot be determined;
critical:	indicates that a service affecting condition has occurred and an immediate corrective action is required;
major:	indicates that a service affecting condition has happened and an urgent corrective action is required;
minor:	indicates the existence of a non-service affecting fault condition and that corrective action should be taken in order to prevent a more serious fault;
warning:	indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt.

Again, reference should be made to ITU Recommendation X.733 [20] for full descriptions.

4.3 Management functions (MF)

In defining the Fault Management Service (MS) for the Xcoop Interface and following the Enesmbles concept, some Management Function Sets (MFS) have been identified. Each MFS has been decomposed in Management Functions (MF). The following MFSs have been identified to manage the eight types of Notifications described in subclause 6.1.2.1:

- Fault notification MFS;
- Alarm event logging MFS;
- Alarm processing MFS.

The identified FM MFSs are organized as depicted in figure 4.

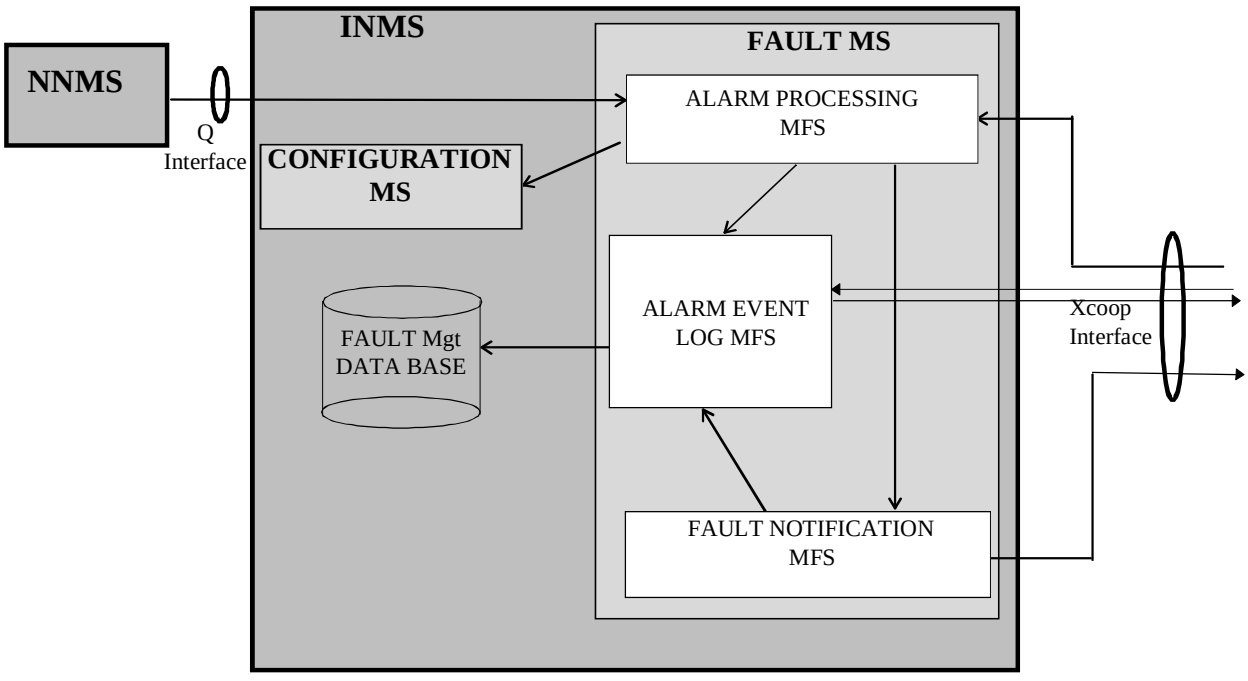


Figure 4: MFSs relative to Fault MS

4.3.1 Fault notification MFS

This MFS performs the following tasks:

- **transmission** of fault notification across the Xcoop interface; these notifications contain the following parameters:

  Sub-networkId, resource id (vpConnectionId, atmAccessPointId), time of event, probable cause, perceived severity, specific problems;

- **forwarding** of sent alarms to the Alarm Event Logging MFS to be recorded in the SALog.

The four types of Fault Notifications previously described for VPSC are summarized in the following figure. In case of an IPPL failure the same notifications are sent but to all NOs instead of only the Origin NO:

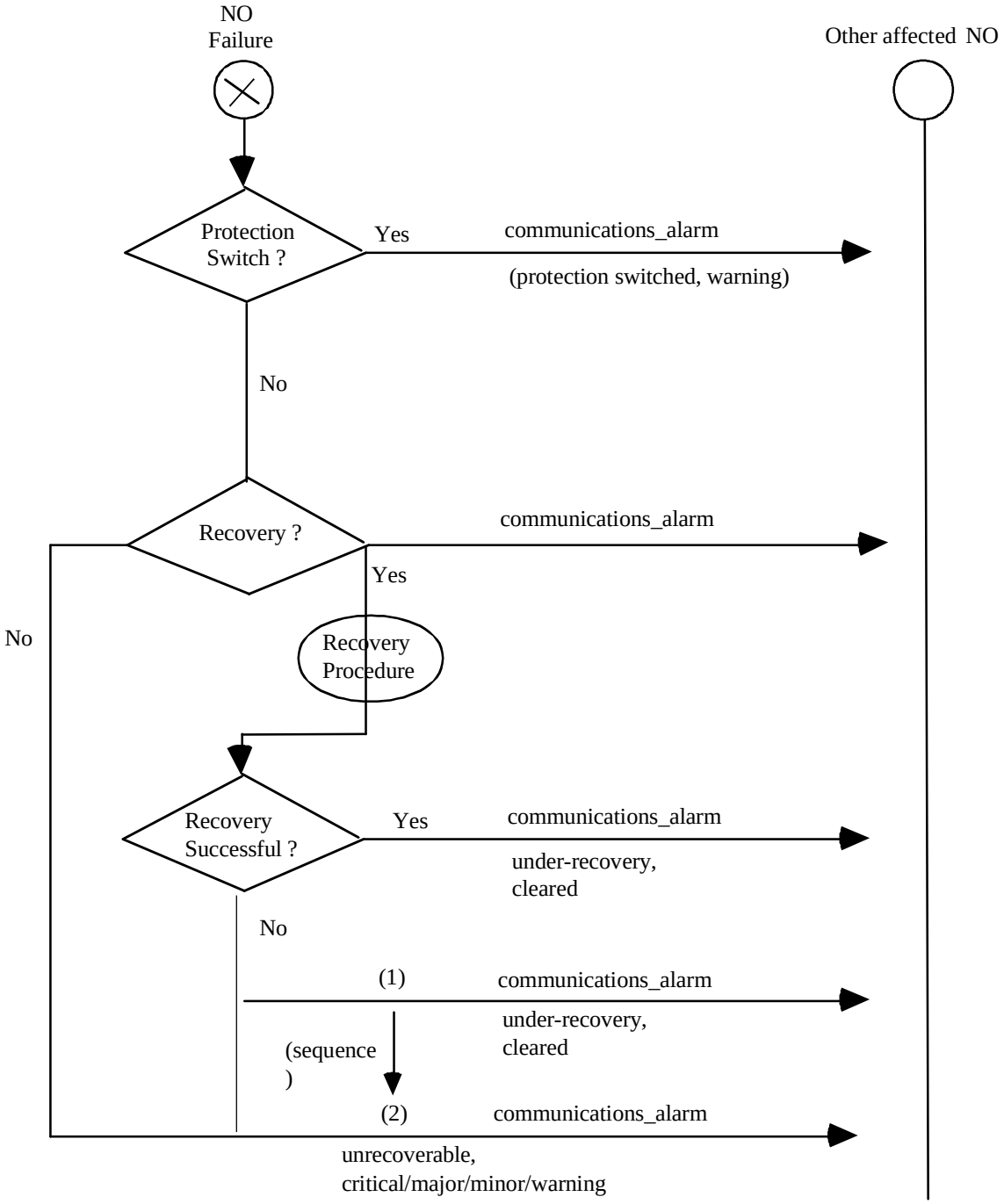


Figure 5: Fault Notification messages

4.3.2 Alarm processing MFS

For the Alarm Processing MFS the following tasks are identified:

- NNMS interface (Not Xcoop related)

  - reception of alarms concerning the part of the national sub-network supporting international connections. It is assumed that these alarms are "qualified" in the sense that the recognition of repeating alarms and the measurement of persistence has been already performed by the NNMS;

  - adaptation of the national alarm to the international format. This adaptation will allow the same treatment for national and international alarms;

  - forwarding the international alarms (i.e. the national alarms that have been adapted to international format and that shall be sent to other NOs) to theFault NotificationN MFS.

- INMS Interface

  - reception of alarms from remote INMSs across the Xcoop interface; the alarm indications will contain the following parameters: Sub-network Id (Sub-network whose NO has detected the Fault), affected resource id (VPconnectionId, pnoNWAtmAccessPoint, ...), time of event, probable cause, perceived severity, and specific problems. It is supposed that the Sub-network has performed recognition of repeating alarms and measurement of persistence before issuing the alarm across the Xcoop interface. The end of the alarm event will be communicated by using the same alarm indication with the perceived severity field set to "cleared";

  - forwarding the received alarms to the RA Log to be stored.

- Filtering

  discrimination and failure localization: it localizes the failure on the basis of the information received from the alarm analysis function. The NO which receives one or more Failure Notification notifications coming from other NOs will be capable of distinguishing the cause of the fault from the inducing causes by analysing the failure notification parameters.

  The Fault Notification is logged in RAlog (see Alarm Event Logging MFS).

4.3.3 Alarm event logging MFS

This task is in charge of managing the interactions with the logs. Logging of alarms may be organized as follows:

- RALog: log of received alarms from remote INMSs, recorded sequentially.
- QALog: is a log which records the qualified alarms, storing begin, end, counting of alarm repetitions.
- SALog: log of sent alarms across the Xcoop interface. This log (and only this type) may also be viewed from a remote INMS.

Therefore this MFS performs the following tasks:

writing alarms (not Xcoop related) on request sent by the Alarm Processing MFS and the Fault Notification MFS. This function records alarm events upon reception of alarm notifications coming from the Xcoop interface (these are recorded in the RALog), before the transmission of alarm notifications across the Xcoop interface (recorded in the SALog) or after the alarm notification has been "qualified" (in order to record also begin time, end time and counting of repetitions). In this last case the alarm is recorded in the QALog as well.

reading information (not Xcoop related) contained in the logs upon request by the operator. This function accesses the SALog, RALog and QALog in order to read alarm records. Some access keys may be identified for accessing the information stored in the logs.

request alarm report: this function is performed (through the Xcoop Interface) when an initiating INMS wants to read the SALog of a remote INMS. The output of this function is the Alarm Record retrieved from the INMS of a remote NO requested by the initiating INMS. It is supposed here that in the request the initiating INMS will specify a set of characteristics of the alarm in order to get the proper Alarm Record.

The identified MF across the Xcoop interface is the following function:

4.3.4 Fault notification (MF)

These are the MFs composing the MFS:

a) MF: Notification of VP Sub-network Connection Protection Switching

MF Name	Notification of VP Sub-network Connection Protection Switching
Functionality	This function generates the emission of a VPSC Protection Switching notification across the Xcoop. This is done in consequence of having received from the NNMS an indication of a protection switching action affecting national sub-network protected resources supporting international communications.
Object class	pnoVpSub-networkConnection
Notifications	"X.721":communicationsAlarm
Instance values	sub-networkId vpConnectionId
Request/parameters	time of event probableCause specificProblems = protection-switched perceivedSeverity = warning
Response/parameters	not confirmed
Security	Writes in the SALog

b) MF: Notification of Inter-PNO Physical Link Protection Switching

MF Name	Notification of Inter-PNO Physical Link Protection Switching
Functionality	This function generates the emission of an IPPL Protection Switching notification across the Xcoop. This is done by the responsible NO in consequence of having received from the NNMS an indication of performing a protection switching procedure on a protected link affected by a recoverable failure.
Object class	pnoNWAtmAccessPoint
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId AtmAccessPointId
Request/parameters	time of event probableCause specificProblems = protection-switched perceivedSeverity = warning
Response /parameters	not confirmed
Security	Writes in the SALog

c) MF: Notification of VP Sub-network Connection Under Recovery

MF Name	Notification of VP Sub-network Connection Under Recovery
Functionality	This function generates the emission of a VPSC Under Recovery notification across the Xcoop. This is done in consequence of having received from the NNMS an indication of a recovery action affecting national sub-network resources supporting international communications.
Object class	pnoVpSub-networkConnection
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId vpConnectionId
Request/parameters	time of event probableCause specificProblems = under-recovery perceivedSeverity = critical OR major OR minor OR warning OR indeterminate (i.e. any valid severity value except "cleared").
Response/parameters	not confirmed
Security	Writes in the SALog

d) MF: Notification of Inter-PNO Physical Link Under Recovery

MF Name	Notification of Inter-PNO Physical Link Under Recovery
Functionality	This function consists in the emission of an IPPL Recovery notification across the Xcoop. This is done by the NO responsible for the link in consequence of the detection of a recoverable failure affecting the link.
Object class	pnoNWAtmAccessPoint
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId AtmAccessPointId
Request/parameters	time of event probableCause specificProblems = under-recovery perceivedSeverity = critical OR major OR minor OR warning OR indeterminate (i.e. any valid severity value except "cleared").
Response /parameters	not confirmed
Security	Writes in the SALog

e) MF: Notification of VP Sub-network Connection Recovery Result

MF Name	Notification of VP Sub-network Connection Recovery Result
Functionality	This function generates the emission of a VPSC Recovery Result notification across the Xcoop. This is emitted after having received from the NNMS an indication of the recovery procedure results.
Object class	pnoVpSub-networkConnection
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId vpConnectionId
Request/parameters	specificProblems = cleared OR unrecoverable perceivedSeverity = cleared OR if unrecoverable then any valid value except "cleared" (but must be the same value as for the corresponding Under Recovery notification)
Response/parameters	not confirmed
Security	Writes in the SALog

f) MF: Notification of Inter-PNO Physical Link Recovery Result

MF Name	Notification of Inter-PNO Physical Link Recovery Result
Functionality	This function generates the emission of an IPPL Recovery Result notification across the Xcoop by the responsible NO. This is done in consequence of having received the recovery procedure results about the affected link
Object class	pnoNWAtmAccessPoint
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId AtmAccessPointId
Request/parameters	specificProblems = cleared OR unrecoverable perceivedSeverity = cleared OR if unrecoverable then any valid value except for cleared (but must be the same value as for the corresponding Under Recovery notification).
Response/parameters	not confirmed
Security	Writes in the SALog

g) MF: Notification of VP Sub-network Connection Unrecoverable

MF Name	Notification of VP Sub-network Connection Unrecoverable
Functionality	This function generates the emission of a VPSC Failure Indication notification across the Xcoop. This is done in consequence of having received from the NNMS an indication of a fault affecting national sub-network resources supporting international communications which are non protected or no recovery procedure is available.
Object class	pnoVpSub-networkConnection
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId vpConnectionId
Request/parameters	specificProblems = Unrecoverable time of event probableCause perceivedSeverity = critical/major/minor/warning/indeterminate (i.e. any valid severity value except "cleared").
Response/parameters	not confirmed
Security	Writes in the SALog

h) MF: Notification of Inter-PNO Physical Link Unrecoverable

MF Name	Notification of Inter-PNO Physical Link Unrecoverable
Functionality	This function consists in the emission of an IPPL Unrecoverable Failure notification across the Xcoop. This is done by the responsible NO in consequence of having received an indication of an unrecoverable failure.
Object class	pnoNWAtmAccessPoint
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId AtmAccessPointId
Request/parameters	time of event probableCause specificProblems = Unrecoverable perceivedSeverity = critical/major/minor/warning/indeterminate (i.e. any valid severity value except "cleared").
Response/parameters	not confirmed
Security	Writes in the SALog

4.3.4.1 Alarm processing MFS

The following function performs the Alarm Processing MFS across the Xcoop-Interface:

MF: Alarm Reception

MF Name	Alarm Reception
Functionality	This function receives alarm notifications sent by remote NOs across the X coop interface.
Object class	vpSub-networkConnection OR pnoNWAtmAccessPoint
Notification	”X.721”:communicationsAlarm
Instance values	sub-networkId sub-networkId OR AtmAccessPointId
Request/parameters	Time of Event Probable cause Perceived severity Specific Problems
Response/parameters	not confirmed
Security	Writes in RALog

4.3.5 Alarm event logging MFS

The following function performs the Alarm Event Logging MFS across the Xcoop-Interface:

MF: Request alarm report

MF Name	Request alarm report
Functionality	This function consists of the emission of a read message across the X interface requesting a remote INMS about an alarm in the SALog. The message sent through the Xcoop interface is a GET request on the **log** object.
Object class	log
Action	get
Instance values	logId
Request/parameters	Access Key (It could be the remote sub-networkId, the pnoNWAtmAccessPointId, vpConnectionId, Probable cause, Perceived severity), ...
Response/parameters	alarmRecord attribute values
Security	Access (only read) to SAlog

4.4 Scenarios

To clarify the exchange of messages across the Xcoop interface, two scenarios are considered:

The first usage case relates to when a failure occurs within a sub-network and the second usage case relates to when a failure occurs on a physical link between two NO's sub-networks.

Case 1

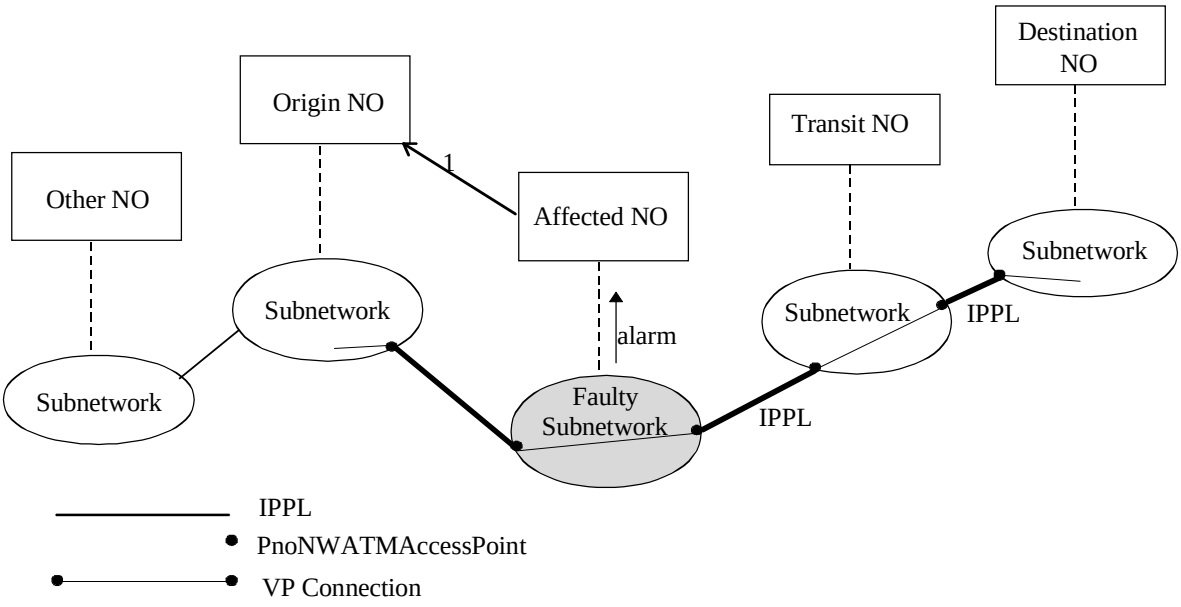


Figure 6: Fault Management when a Sub-network fails

If a Sub-network fails, its INMS (Fault Management) should inform the NOs which are Origin NOs of the VP Sub-network Connections that cross the faulty Sub-network. Figure 2.2a represents the Fault Management Process in the case that just one VP Sub-network Connection makes use of the faulty Sub-network resources. In this case a VPSC notification is sent to the one Origin NO indicated. Clearly, the process would have to be repeated "n" times for "n" different origin NOs using the faulty Sub-network at the time of failure.

Case 2

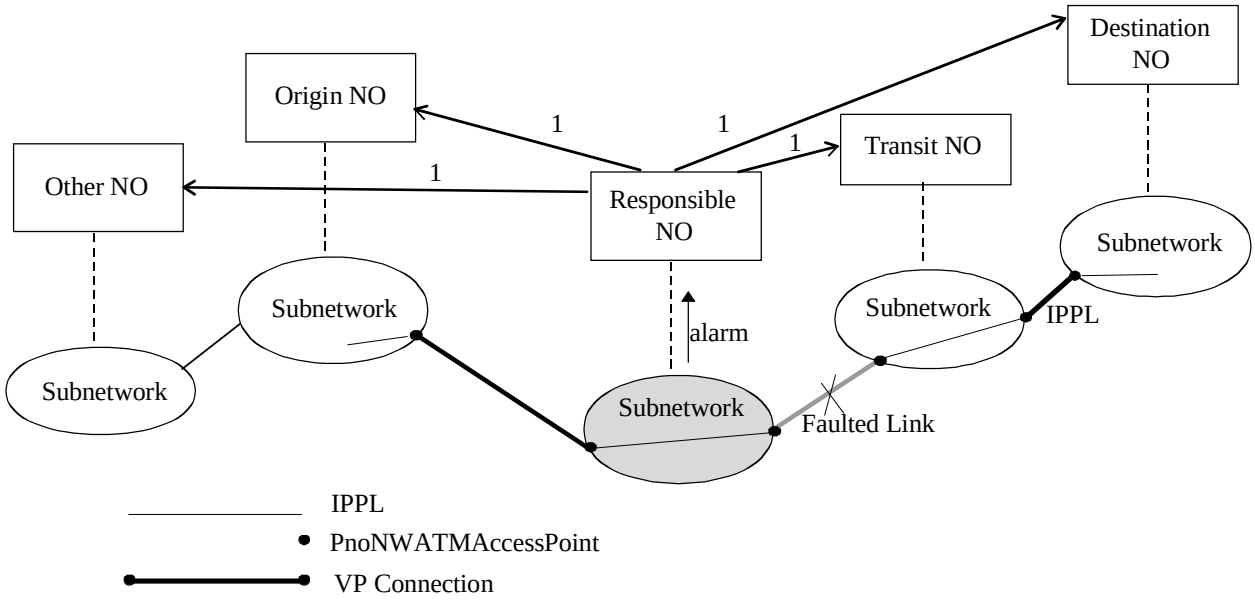


Figure 7: Fault Management when an Inter-PNO Physical Link fails

If an Inter-PNO Physical Link fails, only one of the two NOs connected by the link becomes responsible for forwarding this failure through the Xcoop Interface. Each InterPNO Physical Link should have a NO assigned as responsible in terms of Fault Management and this assignment should be done "a priori" by bilateral agreements or otherwise when the complete International Network is settled.

The responsible NO informs ALL the other NOs in the International Network about the Fault process of the Inter PNO Physical Link, even if they have no VP connection in common. The reason for informing all the NOs is that the Topology Information of each NO should be updated. This is especially important in case of an unrecoverable failure when a corresponding unrecoverable failure notification is sent to all NOs in the international network scheme where management is undertaken using the Xcoop interface.

5 Management information

5.1 Relationships

The information model described in this subclause considers the descriptions of clauses 6 and 7. A relationship can also be drawn with respect to CCITT Recommendation M.3400 [2] and the CCITT X.7xx series that is related to CCITT Recommendation M.3400 [2].

The inheritance tree of the log objects is shown in figure 8.

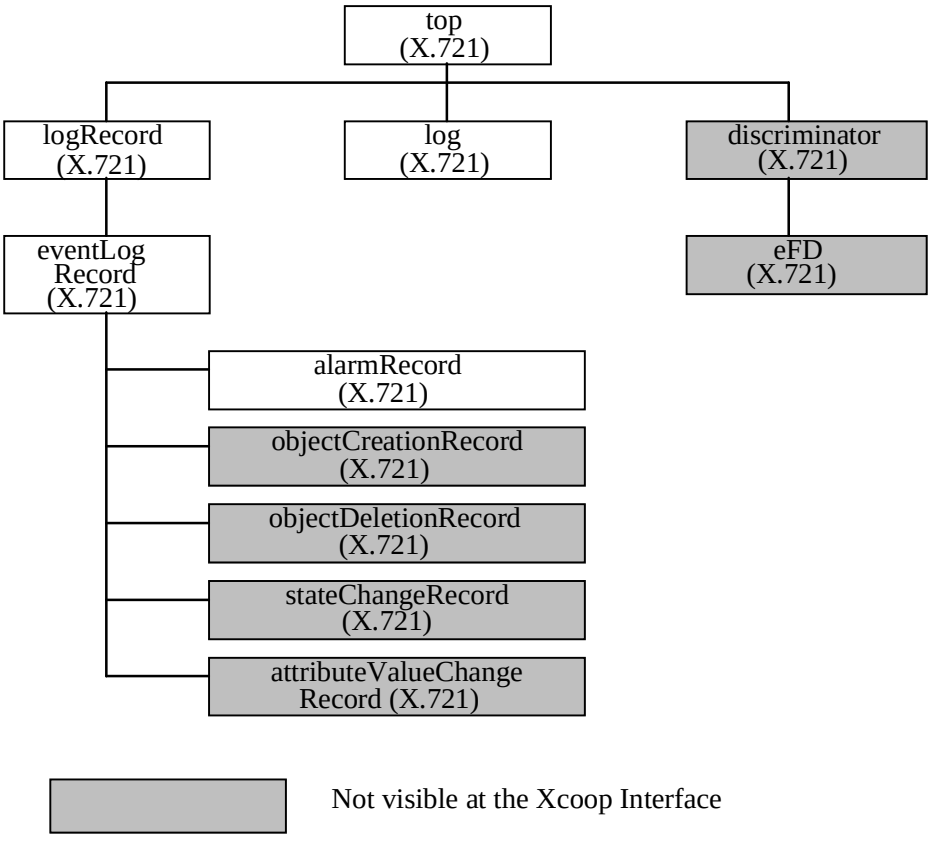


Figure 8: Inheritance Tree

To fulfil the management services described in subclause 6.1, the object classes shown in the Naming tree in figure 9 are used. The next subclause details this Information Model in GDMO and ASN.1 terms.

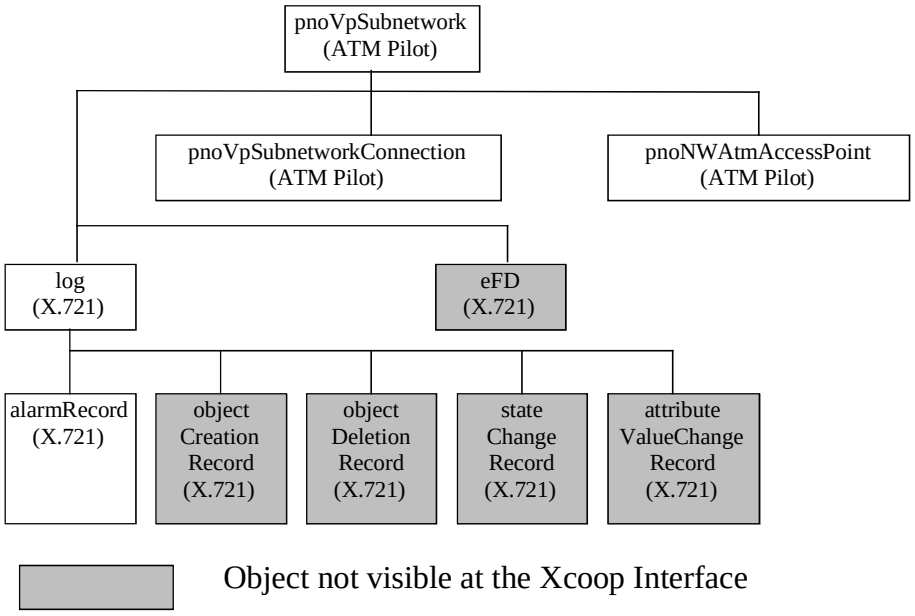


Figure 9: Naming Tree

IPPL failures are related to the pnoNWAtmAccessPoint object class while the VPSC failures relate to the pnoVpSubnetworkConnection object class. Accordingly, it is necessary to include both object classes in the naming tree.

The log object class represents the complete set of alarm records without specifically distinguishing for pnoVpSubnetworkConnection and for pnoNWAtmAccessPoint.

The discriminatorConstruct attribute (type defined as CMISE Filter) of the dedicated log object instance(s) has to be set in accordance with the required event reports (Fault Notifications) received across the Xcoop interface to enable the creation of the corresponding object instances of eventLogRecord subclasses. This approach covers the requirements for RALog Records.

Read access to the Sent Alarm log records across the Xcoop interface of any NO could be enabled by setting the authorization profiles accordingly.

The object class and eFD are not seen on the Xcoop interface. These resources are needed within the Fault Management System for sending the different fault management messages, as described in D6, annex 1.

The notifications crossing the Xcoop interface are described in the Fault Management specification normally within the behaviour description of the object classes. The parameters contained in these notifications are also defined.

NOTE: The following information could be used for implementation.

The requirements for SALog Records are covered by setting the discriminatorConstruct attribute of the dedicated eventForwardingDiscriminator object instance(s) in accordance with the required event reports (Fault Notification) to be sent across the Xcoop interface. The event reports then can be logged, forwarded or displayed by the adjacent OS.

The requirements of QALog Records could be covered in the same way as the sent/received records.

5.2 Xcoop GDMO description

For the GDMO description please refer to ETSI NA 52212.1 V6.

5.3 Xcoop fault management ASN.1 module

The ASN.1 module below provides an abstract syntactical description of the Xcoop GDMO. As such, it gives an implementation and platform independent description of the object classes required in the interface definition.

ASN1XcoopFaultModule { ccitt(0) identified-organization (4) etsi (0) xcoop (0) informationModel(0) asn1Module(2) asn1XcoopFaultModule(1) }

```
DEFINITIONS

BEGIN

IMPORTS SpecificProblems, SpecificIdentifier

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

xfSpecificProblems OBJECT IDENTIFIER ::= { ccitt(0) identified-organization (4) etsi (0) xcoop (0)
informationModel(0) specificExtension(0) xcfault (0) }

cleared SpecificProblems ::= globalValue: { xfSpecificProblems 0}

protectionSwitched SpecificProblems ::= globalValue: { xfSpecificProblems 1}

under-recovery SpecificProblems ::= globalValue: { xfSpecificProblems 2}

unrecoverable SpecificProblems ::= globalValue: { xfSpecificProblems 3}

END
```

Annex A (normative): SDL diagrams

The NO Xcoop manager contains an SDL state diagram for each VP for which the NO is responsible. As stated previously, the NO is responsible for all VP connections originating in its domain and the Inter-PNO Physical Links for which it has been assigned responsibility before starting the service.

The states which a given VP connection can be in are: enabled, recovering and failed.

History

Document history			
V 1.2.1	October 1997	Public Enquiry	PE 9807: 1997-10-17 to 1997-02-13