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Technical Specification

**Universal Mobile Telecommunications System (UMTS);
Telecommunication management;
Fault Management;
Part 4: Alarm Integration Reference Point: CMIP solution set
(3GPP TS 32.111-4 version 5.1.0 Release 5)**



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The present document is part 4 of a multi-part TS covering the Telecommunication Management; Fault Management; Part 4: Alarm Integration Reference Point: CMIP solution set, as identifies below:

- Part 1: "3G Fault Management Requirements";
- Part 2: "Alarm Integration Reference Point: Information Service";
- Part 3: "Alarm Integration Reference Point: CORBA Solution Set";
- Part 4: "Alarm Integration Reference Point: CMIP Solution Set".**

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1 Scope

The present document defines the alarm integration reference point for the CMIP solution set. In detail:

- clause 4 contains an introduction to some basic concepts of the CMIP interfaces;
- clause 5 contains the GDMO definitions for the Alarm Management over the CMIP interfaces;
- clause 6 contains the ASN.1 definitions supporting the GDMO definitions provided in clause 5.

This Solution Set specification is related to 3G TS 32.111-2 V5.0.X.

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.
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- [1] 3GPP TS 32.302: "Telecommunication Management; Configuration Management; Notification Integration Reference Point; Information Service version 1 Point: Information Service".
- [2] ITU-T Recommendation X.710: "Information technology - Open Systems Interconnection - Common Management Information Service".
- [3] ITU-T Recommendation X.711: "Information technology - Open Systems Interconnection - Common Management Information Protocol: Specification".
- [4] ITU-T Recommendation X.721: "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".
- [5] ITU-T Recommendation X.733: "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".
- [6] ITU-T Recommendation X.734: "Information technology - Open Systems Interconnection - Systems Management: Event report management function".
- [7] ITU-T Recommendation Q.821: "Stage 2 and Stage 3 description for the Q3 interface - Alarm Surveillance".
- [8] 3GPP TS 32.111-1: "Telecommunication Management; Fault Management; Part 1: 3G Fault management requirements".
- [9] 3GPP TS 32.111-2: "Telecommunication Management; Fault Management; Part 2: Alarm Integration Reference Point: Information Service Version 1".
- [10] 3GPP TS 32.304: "Telecommunication Management; Configuration Management; Notification Integration Reference Point: CMIP Solution Set Version 1:1".
- [11] 3GPP TS 32.312: "Telecommunication management; Generic IRP Management: InformationService".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions defined in 3GPP TS 32.111-1 [8] apply.

3.2 Abbreviations

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

ASN.1	Abstract Syntax Notation number 1
CCITT	The International Telegraph and Telephone Consultative Committee
CM	Configuration Management
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
EFD	Event Forwarding Discriminator
EM	Element Manager
FTAM	File Transfer Access and Management
GDMO	Guidelines for the Definition of Managed Objects
IOC	Information Object Class
IRP	Integration Reference Point
Itf-N	Interface N (between NM and EM/NE)
ITU-T	International Telecommunication Union – Telecommunications
M	Mandatory
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NM	Network Manager
NMC	Network Management Centre
O	Optional
OS	Operations System
TMN	Telecommunications Management Network

4 Basic aspects

The present document provides all the GDMO and ASN.1 definitions necessary to implement the Alarm IRP Information Service [9] for the CMIP interface. The Alarm IRP Information Service description is based on Information Object Classes (IOC), Relationships among IOC and Interfaces (used or implemented by IOC) which include Operations and/or Notifications.

In the present document, for the CMIP interfaces the IOC are modelled as GDMO "Managed Object Classes" (MOC) defined specifically for alarm management, the Operations are modelled as GDMO "Actions" of a MOC while the Notifications are modelled as GDMO "Notifications" included in MOCs that need to report events to the Manager. In more detail, the Notifications related to alarm management are included in a MOC defined in the present document while the Notifications defined for alarm reporting are not included in any MOC defined in the present document. They will be included in other MOCs defined in other CMIP Solution Set or in other CMIP Information Models.

Regarding the Notifications, the present document is based on the Notification IRP CMIP Solution Set (3GPP TS 32.304 [10]).

4.1 Reporting new alarms

In case of an alarm occurrence the Agent notifies all subscribed Managers that a new alarm has occurred and has been added into the alarm list of the Agent.

For this purpose the standardised alarm notifications defined in [4] and [5] are used.

4.2 Reporting changed alarms

Although in the Alarm IRP Information Service [9] there is a notification specifically defined to report the event of alarm attribute changes, on the CMIP interfaces such events are reported according to [4] and [5], i.e. the original alarm is first cleared (by means of a clear alarm notification) and then a new alarm notification with the changed parameter values is generated by the Agent.

4.3 Reporting cleared alarms

On the CMIP interfaces the clearing of alarms is reported by the Agent to the Managers in accordance with the mechanisms defined in ITU-T Recommendation X.733 [5] and ITU-T Recommendation Q.821 [7].

4.4 Acknowledgment of alarms

This clause relates to the co-operative alarm acknowledgment managed on Itf-N, which implies that the acknowledgment of alarms can be done on both NM and EM.

The acknowledgment of alarms is managed by means of the MOC `alarmControl`, which includes:

- One Action to acknowledge alarms;
- One Action to un-acknowledge alarms;
- ITU-T Recommendation X.721 [4] compliant Alarm Notification to inform Managers about changes of acknowledgment state.

In case an alarm is acknowledged by an operator or automatically by a management system, the `ackUserId`, `ackSystemId`, `ackState` and `ackTime` information is stored in the *additionalInformation* field of the alarm present in the alarm list.

4.5 Management of comments associated to alarms

This feature provides the Operators with the capability to add comments to an alarm and to share such information among all the OS (EM and NM) that are involved in the network management. An OS shall have the capability to record more than one comment for each alarm.

The management of the comments associated to alarms is similar to the management of the acknowledgment of alarms and is achieved by means of the same MOC `alarmControl`. For the management of the comments, the MOC `alarmControl` includes one Action to set the comment and Notification to distribute the comments to other OS.

4.6 Alignment of alarm conditions over the Itf-N

The IRP Manager is able to trigger the alarm conditions alignment using the Action *getAlarmList*

The following specifies the logical steps of the alignment procedure, by describing a possible implementation. Any other implementation showing the same behaviour on the Itf-N interface is compliant with the present document.

- The Manager sends to the Agent a *getAlarmList* request containing the following information:
 - *alarmAckState*, used to select the alarms from the Agent's alarm list for the current alignment (e.g. all active alarms).
 - *destination*, identifying the destination to which event reports that have passed the filter conditions are sent.
 - *filter*, this optional parameter defines the conditions an alarm notification shall fulfil in order to be forwarded to the Manager. It applies only for the current alignment request.
- After evaluation of the request, the Agent first generates an *alignmentId* value, which unambiguously identifies this alignment process. This value is used by the Manager to correlate alarm reports to the corresponding alignment requests, in case this Manager issues several alarm alignments in parallel.

- The Agent creates a temporary Event Forwarding Discriminator (EFD) instance for the purpose of this alarm alignment, using the parameters *destination* and *filter* received in the request. If the *filter* parameter is absent or NULL, all alarm notifications are forwarded to the Manager through this EFD, according to the value of the parameter *alarmAckState*.
The filter is set by the Agent automatically in order to forward to only those alarm notifications containing, at the beginning of the field *additionalText*, either the string "(ALIGNMENT-<alignmentId>)" or the string "(ALIGNMENTEND-<alignmentId>)".
- The Agent sends back a *getAlarmList* response, which contains the *alignmentId* described above and the *status* information, indicating the result of the request. (see the message flow in Figure 1).
- The Agent scans now its alarm list. For every alarm, which matches the criteria defined by the *alarmAckState* parameter, the Agent inserts, at the beginning of the field *additionalText*, the string "(ALIGNMENT-<alignmentId>)". According to ITU-T Recommendation X.734 [6], the Agent forwards these alarm notifications towards all EFDs.
In the last alarm of the list the Agent inserts the string "(ALIGNMENTEND-<alignmentId>)" to indicate the end of the alarm alignment.

NOTE: These alarm notifications can reach the current Manager only via the temporary EFD created for the current alignment. They are filtered out:

- a) By all the EFD instances used for "real-time" alarm reporting, due to the presence of the sub-string "ALIGNMENT" in the field *additionalText* (see 3GPP TS 32.304 [10]).
 - b) By all temporary EFD instances possibly created for parallel alignments, due to the presence of the unambiguous sub-string "<alignmentId>" in the *additionalText* field.
- After sending the last alarm report (identified by the sub-string "ALIGNMENTEND" in the *additionalText*), the Agent automatically deletes the temporary EFD instance (see figure 1).

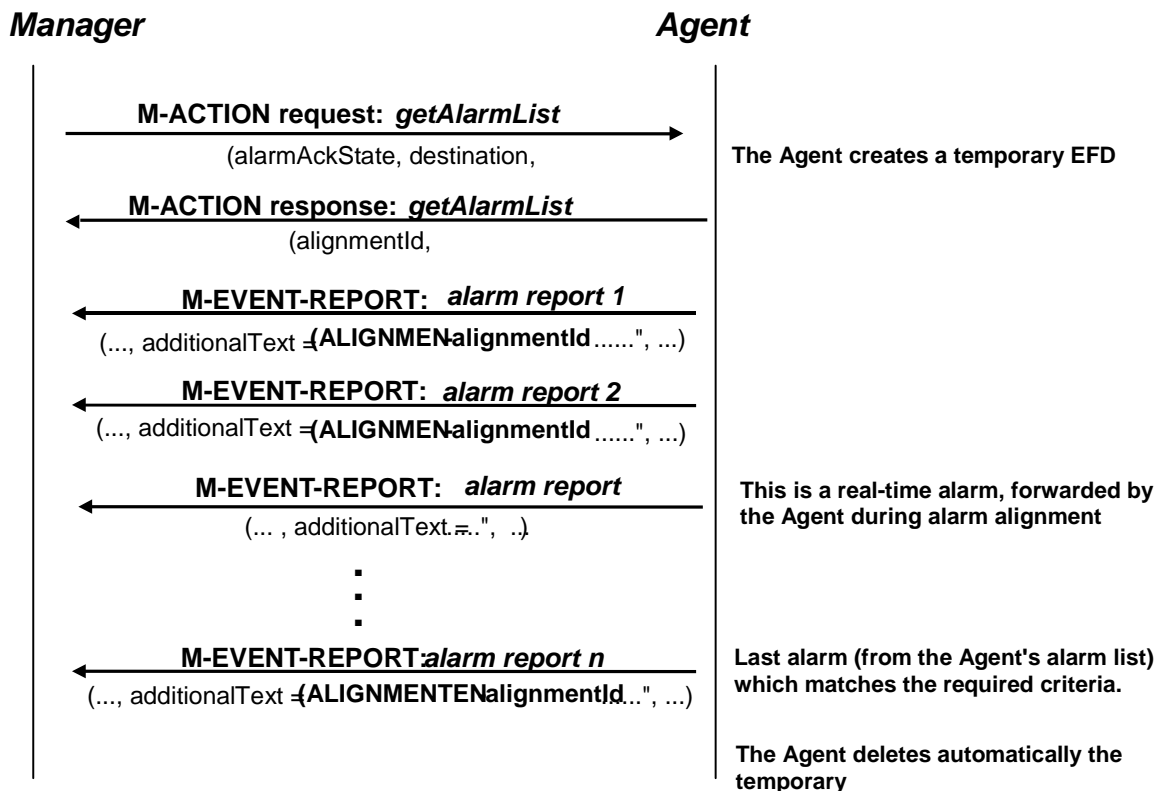


Figure 1: Alignment arrow diagram

Figure 2 shows the handling of a "real-time" alarm notification (occurred during the execution of the *getAlarmList* operation), which is forwarded by the Agent (according to ITU-T Recommendation X.734 [6]) to all currently available EFD instances. Dependent on the *discriminatorConstruct* setting of every EFD, such an alarm may or may not reach the related Manager. In any case, this alarm is filtered out by the temporary EFD assigned to the Manager, which triggered the *getAlarmList* request.

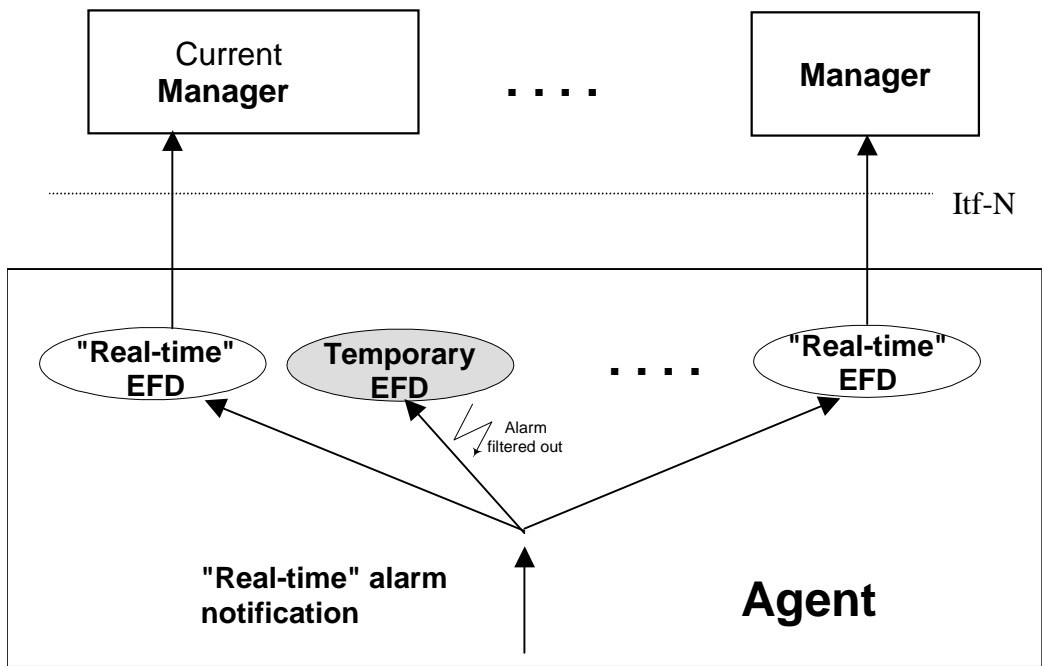


Figure 2: Treatment of "real time" alarms

Figure 3 shows the handling of an alarm notification from the alarm list, matching the criteria defined in the parameters *alarmAckState* of the *getAlarmList* request and forwarded by the Agent to all EFD instances as well. This alarm is filtered out by all EFD instances in charge of discrimination of "real-time" alarms and can reach only the Manager, which triggered the *getAlarmList* request, because it passes the temporary EFD instance assigned to this Manager.

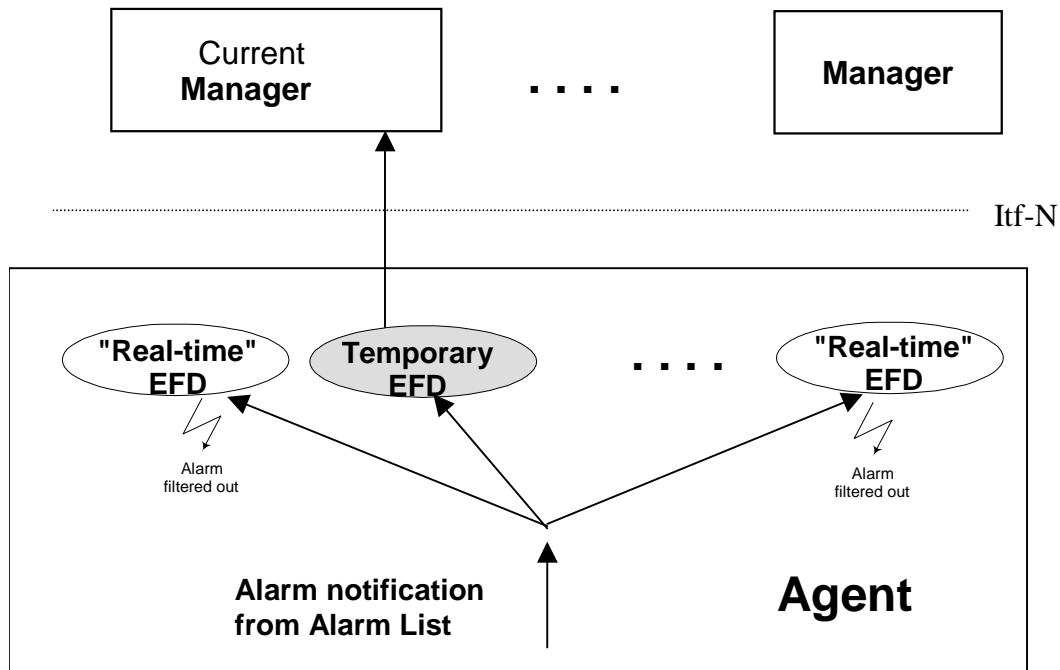


Figure 3: Treatment of "alignent" alarms

4.7 Mapping

The semantics of the Alarm IRP is defined in 3GPP TS 32.111-2 [9]. The definitions of the management information defined there are independent of any implementation technology and protocol. This clause maps these protocol-independent definitions onto the equivalences of the CMIP solution set of Alarm IRP.

4.7.1 Mapping of IOC and Interfaces

For this Alarm IRP CMIP Solution Sets, the Information Object Classes (IOC) and the Interfaces defined in TS 32.111-2 [9] are mapped to a Managed Object Classes (MOC) named `alarmControl` which includes all the Attributes, Actions and Notifications necessary to model the management described in [9].

4.7.2 Mapping of Interface/Operations

Table 1 maps the Interface/Operations defined in the IS of the Alarm IRP to their equivalents in the CMIP SS. The equivalents are qualified as Mandatory (M) or Optional (O).

Table 1: Mapping of Operations

Interface/Operations of the Alarm IRP Information Services	GDMO Actions of CMIP Solution Set	Qualifier
AlarmIRPOperations_1/acknowledgeAlarms	acknowledgeAlarms	M
AlarmIRPOperations_1/getAlarmList	getAlarmList	M
AlarmIRPOperations_2/getAlarmCount	getAlarmCount	O
AlarmIRPOperations_3/unacknowledgeAlarms	unacknowledgeAlarms	O
AlarmIRPOperations_4/setComment	setComment	O
GenericIRPVersionOperation/getIRPVersion	getAlarmIRPVersion	M
GenericIRPPProfileOperation/getNotificationProfile	getNotificationProfile	O
GenericIRPPProfileOperation/getOperationProfile	getOperationProfile	O

NOTE: the Interfaces `GenericIRPVersionOperation` and `GenericIRPPProfileOperation` are defined in [11].

4.7.3 Mapping of Parameters of each operation

The tables in the following clauses show the parameters of each operations defined in the IS 3GPP TS 32.111-2 [9] and their equivalents in this CMIP SS.

The input parameters of the operations are mapped into "Action information" (see GDMO and ASN.1 definitions for more details).

The output parameters of the operations are mapped into "Action response" (see GDMO and ASN.1 definitions for more details).

Table 2: Mapping of parameters of 'acknowledgementAlarms'

Operation parameters of Information Services	IN/OUT	CMIP equivalences	Qualifier
alarmInformationAndSeverityReferenceList	IN	AlarmReferenceList (note)	M
ackUserId	IN	ackUserId	M
ackSystemId	IN	ackSystemId	O
badAlarmInformationReferenceList	OUT	errorAlarmReferenceList	M
status	OUT	status	M
NOTE: severity verification not required in CMIP solution set			

Table 3: Mapping of Parameters of 'getAlarmCount'

Operation parameters of Information Services	IN/OUT	CMIP equivalents	Qualifier
filter	IN	filter	O
alarmAckState	IN	alarmAckState	O
criticalCount	OUT	criticalCount	M
majorCount	OUT	majorCount	M
minorCount	OUT	minorCount	M
warningCount	OUT	warningCount	M
indeterminateCount	OUT	indeterminateCount	M
clearedCount	OUT	clearedCount	M
status	OUT	status	M

Table 4: Mapping of Parameters of 'getAlarmList'

Operation parameters of Information Services	IN/OUT	CMIP equivalents	Qualifier
filter	IN	filter	O
alarmAckState	IN	alarmAckState	O
--		destination (input) - see note 1	M
alarmInformationList	OUT	(sequence of alarm notifications) (see clause 4.5)	M
status	OUT	status	M
--		alignmentId (output) - see note 2	M
NOTE 1: Destination is a CMIP specific parameter and is determined by the Manager.			
NOTE 2: AlignmentId is a CMIP specific parameter and is determined by the Agent.			

Table 5: Mapping of Parameters of 'getAlarmIRPVersion'

Operation parameters of Information Services	IN/OUT	CMIP equivalents	Qualifier
versionNumberSet	OUT	versionNumberList	M
status	OUT	status	M

Table 6: Mapping of Parameters of 'getOperationProfile'

Operation parameters of the Information Services.	IN/OUT	CMIP Solution Set equivalences	Qualifier
irpVersion	IN	irpVersionNumber	M
operationNameProfile	OUT	operationNameProfile	M
operationParameterProfile	OUT	operationParameterProfile	M
status	OUT	status	M

Table 7: Mapping of Parameters of 'getNotificatioProfile'

Operation parameters of the Information Services.	IN/OUT	CMIP Solution Set equivalences	Qualifier
irpVersion	IN	irpVersionNumber	M
notificationNameProfile	OUT	notificationNameProfile	M
notificationParameterProfile	OUT	notificationParameterProfile	M
status	OUT	status	M

Table 8: Mapping of Parameters of 'setComment'

Operation parameters of Information Services	IN/OUT	CMIP equivalents	Qualifier
alarmInformationReferenceList	IN	alarmReferenceList	M
commentUserId	IN	commentUserId	M
commentSystemId	IN	commentSystemId	O
commentText	IN	commentText	M
badAlarmInformationReferenceList	OUT	badAlarmReferenceList	M
Status	OUT	status	M

Table 9: Mapping of Parameters of 'unacknowledgeAlarms'

Operation parameters of Information Services	IN/OUT	CMIP equivalents	Qualifier
alarmInformationReferenceList	IN	alarmReferenceList	M
ackUserId	IN	ackUserId	M
ackSystemId	IN	ackSystemId	O
badAlarmInformationReferenceList	OUT	errorAlarmReferenceList	M
status	OUT	status	M

4.7.4 Mapping of Notifications

Table 10 maps the Notifications defined in the Information Service of the Alarm IRP to the equivalent Notifications of the CMIP solution set for the Alarm IRP. The CMIP Notifications are qualified as Mandatory (M) or Optional (O).

Table 10: Mapping of Notifications

Notifications of Information Services of the Alarm IRP	Equivalent Notifications of the CMIP solution set for the Alarm IRP	Qualifier
notifyNewAlarm	environmentalAlarm ITU-T X.721 [4] equipmentAlarm ITU-T X.721 [4] qualityofServiceAlarm ITU-T X.721 [4] processingErrorAlarm ITU-T X.721 [4] communicationAlarm ITU-T X.721 [4]	M
notifyChangedAlarm	notifyClearedAlarm notifyNewAlarm which are in turn mapped into environmentalAlarm ITU-T X.721 [4] equipmentAlarm ITU-T X.721 [4] qualityofServiceAlarm ITU-T X.721 [4] processingErrorAlarm ITU-T X.721 [4] communicationAlarm ITU-T X.721 [4]	O
notifyClearedAlarm	environmentalAlarm ITU-T X.721 [4] equipmentAlarm ITU-T X.721 [4] qualityofServiceAlarm ITU-T X.721 [4] processingErrorAlarm ITU-T X.721 [4] communicationAlarm ITU-T X.721 [4]	M
notifyAckStateChanged	environmentalAlarm ITU-T X.721 [4] equipmentAlarm ITU-T X.721 [4] qualityofServiceAlarm ITU-T X.721 [4] processingErrorAlarm ITU-T X.721 [4] communicationAlarm ITU-T X.721 [4]	M
notifyAlarmListRebuilt	notifyAlarmListRebuilt	M
notifyComments	notifyComments	O
notifyPotentialFaultyAlarmList	notifyPotentialFaultyAlarmList	O

4.7.5 Mapping of Parameters of each notification

In the CMIP Solution Set, all the notifications originated within the Agent are reported to the Managers by means of the CMISE "M-EVENT-REPORT" primitive, which is implemented by means of the "m-EventReport OPERATION" (see [2] and[3]). The argument of m-EventReport OPERATION is defined in [3] as follows:

```

EventReportArgument ::= SEQUENCE {
    managedObjectClass      ObjectClass,
    managedObjectInstance   ObjectInstance,
    eventTime                [5] IMPLICIT GeneralizedTime OPTIONAL,
    eventType                EventTypeID,
    eventInfo                [8] ANY DEFINED BY eventType OPTIONAL
}

```

where `eventInfo` is further specified, for each specific notification, by means of specific GDMO/ASN1 definitions.

In the following tables, for the notifications defined in [9], all parameters are mapped to their CMIP SS equivalents. Note that the parameter mapping for the notification `notifyChangedAlarm` is not given. This is because in the CMIP SS the notifications `notifyClearedAlarm` and `notifyNewAlarm` are emitted instead of the notification `notifyChangedAlarm`.

The IS parameter `systemDN` defined in [9] (Alarm IRP: Information Services) is conditional and not used in the CMIP SS.

Except for the notification `notifyComments` the IS parameter `alarmType` has no direct CMIP SS equivalent. Instead the value of this parameter is reflected by the type of the emitted notification. More specifically

- If the event type is equal to 'Communication Alarm' the notification `communicationsAlarm` is emitted;
- If the event type is equal to 'Processing Error Alarm' the notification `processingErrorAlarm` is emitted;
- If the event type is equal to 'Environmental Alarm' the notification `environmentalAlarm` is emitted;
- If the event type is equal to 'Quality of Service Alarm' the notification `qualityofServiceAlarm` is emitted;
- If the event type is equal to 'Equipment Alarm' the notification `equipmentAlarm` is emitted.

Also the IS parameter alarmId is not mapped directly to a parameter in the CMIP SS. This is not required because an alarm is identified unambiguously by the notification identifier of the notification reporting the alarm the first time and the instance of the managed object emitting this notification. Notifications referring to an alarm already reported (e. g. notifyClearedAlarm, notifyAckStateChanged, notifyComments) do so by specifying in the M-EVENT REPORT parameter 'Event information': correlatedNotifications (X.721 [4] and X.733 [5]) the notification identifier of the notification having reported the new alarm and, if required, the instance of the object having emitted this notification.

Table 11: Mapping of Parameters of "notifyNewAlarm"

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectclass	M-EVENT REPORT parameter 'Managed object class'	M
objectInstance	M-EVENT REPORT parameter 'Managed object instance'	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event time'	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter 'Event type'	M
probableCause	M-EVENT REPORT parameter 'Event information': probableCause	M
specificProblems	M-EVENT REPORT parameter 'Event information': specificProblems	O
perceivedSeverity	M-EVENT REPORT parameter 'Event information': perceivedSeverity	M
alarmType	The semantics of this parameter is conveyed by the notification type.	--
backedUpStatus	M-EVENT REPORT parameter 'Event information': backedUpStatus	O
backUpObject	M-EVENT REPORT parameter 'Event information': backUpObject	O
trendIndication	M-EVENT REPORT parameter 'Event information': trendIndication	O
thresholdInfo	M-EVENT REPORT parameter 'Event information': thresholdInfo	O
correlatedNotifications	M-EVENT REPORT parameter 'Event information': correlatedNotifications	O
stateChangeDefinition	M-EVENT REPORT parameter 'Event information': stateChangeDefinition	O
monitoredAttributes	M-EVENT REPORT parameter 'Event information': monitoredAttributes	O
proposedRepairActions	M-EVENT REPORT parameter 'Event information': proposedRepairActions	O
additionalText	M-EVENT REPORT parameter 'Event information': additionalText	O
alarmId	--	--

Table 11: Mapping of Parameters of "notifyClearedAlarm"

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectclass	M-EVENT REPORT parameter 'Managed object class'	M
objectInstance	M-EVENT REPORT parameter 'Managed object instance'	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event time'	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter 'Event type'	M
probableCause	M-EVENT REPORT parameter 'Event information': probableCause	M
perceivedSeverity	M-EVENT REPORT parameter 'Event information': perceivedSeverity	M
alarmType	The semantics of this parameter is conveyed by the notification type.	--
correlatedNotifications	M-EVENT REPORT parameter 'Event information': correlatedNotifications	O
alarmId	M-EVENT REPORT parameter 'Event information': correlatedNotifications	M

Table 12: Mapping of Parameters of 'notifyAckStateChanged'

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectclass	M-EVENT REPORT parameter 'Managed object class'	M
objectInstance	M-EVENT REPORT parameter 'Managed object instance'	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event time'	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter 'Event type'	M
probableCause	M-EVENT REPORT parameter 'Event information': probableCause	M
perceivedSeverity	M-EVENT REPORT parameter 'Event information': perceivedSeverity	M
alarmType	The semantics of this parameter is conveyed by the notification type.	--
alarmId	M-EVENT REPORT parameter 'Event information': correlatedNotifications	--
ackTime	M-EVENT REPORT parameter 'Event information': additionalInformation	M
ackState		M
ackUserId		M
ackSystemId		O

Table 13: Mapping of Parameters of 'notifyAlarmListRebuilt'

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectclass	M-EVENT REPORT parameter 'Event information': rebuiltObjectClass	M
objectInstance	M-EVENT REPORT parameter 'Event information': rebuiltObjectInstance	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event time'	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter 'Event type'	M
reason	M-EVENT REPORT parameter 'Event information': reason	M
alarmListAlignmentRequirement	M-EVENT REPORT parameter 'Event information': alarmListAlignmentRequirement (note)	O
NOTE: This parameter shall be supported only, if the IRPAgent supports the notification notifyPotentialFaultyAlarmList.		

Table 14: Mapping of Parameters of 'notifyComments'

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectClass	M-EVENT REPORT parameter 'Event information': alarmedObjectClass	M
objectInstance	M-EVENT REPORT parameter 'Event information': alarmedObjectInstance	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event information': alarmEventTime	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter 'Event type'	M
alarmType	M-EVENT REPORT parameter 'Event information': alarmType	M
probableCause	M-EVENT REPORT parameter 'Event information': alarmProbableCause	M
perceivedSeverity	M-EVENT REPORT parameter 'Event information': alarmPerceivedSeverity	M
comments	M-EVENT REPORT parameter 'Event information': comments	M
alarmId	M-EVENT REPORT parameter 'Event information': correlatedNotifications	--

Table 15: Mapping of Parameters of 'notifyPotentialFaultyAlarmList'

IS Parameter Name	CMIP SS Equivalent	Qualifier
objectClass	M-EVENT REPORT parameter 'Event information': potentialFaultyObjectClass	M
objectInstance	M-EVENT REPORT parameter 'Event information': potentialFaultyObjectInstance	M
notificationId	M-EVENT REPORT parameter 'Event information': notificationIdentifier	M
eventTime	M-EVENT REPORT parameter 'Event time'	M
systemDN	--	--
notificationType	M-EVENT REPORT parameter: 'Event type'	M
reason	M-EVENT REPORT parameter 'Event information': reason	M

5 GDMO definitions

5.1 Managed Object Classes

5.1.1 alarmControl

This Managed Object Class (MOC) models the alarm information available within the Agent and significant for the NM-EM interface. It deals with both **active** and **cleared but not yet acknowledged** alarms. The NMC may initiate the transfer of current alarms according to the required parameters in the M-ACTION request 'getAlarmList'.

```
alarmControl MANAGED OBJECT CLASS
DERIVED FROM
    "Rec. X.721 | ISO/IEC 10165-2 : 1992":top;
CHARACTERIZED BY
    alarmControlBasicPackage,
    alarmAcknowledgementPackage,
    alarmIRPVersionPackage;

CONDITIONAL PACKAGES
    alarmCountPackage PRESENT IF "an instance supports it",
    alarmCommentPackage PRESENT IF "an instance supports it",
    alarmProfilePackage PRESENT IF "an instance supports it",
    alarmUnacknowledgementPackage PRESENT IF "an instance supports it ",
    alarmPotentialFaultyAlarmListPackage PRESENT IF "an instance supports it ";
REGISTERED AS { ts32-111AlarmObjectClass 1};
```

5.2 Packages

5.2.1 alarmControlBasicPackage

```
alarmControlBasicPackage PACKAGE
BEHAVIOUR
    alarmControlBasicPackageBehaviour;
ATTRIBUTES
    alarmControlId          GET,
    alarmsCountSummary      GET;
ACTIONS

    getAlarmList;
NOTIFICATIONS
    alarmListRebuilt;
REGISTERED AS { ts32-111AlarmPackage 1};
```

```
alarmControlBasicPackageBehaviour BEHAVIOUR
DEFINED AS
```

"The MOC alarmControl has been defined to provide information to the Manager about the currently alarms controlled by the Agent.

An instance of the 'alarmControl' MOC is identified by the value of the attribute 'alarmControlId'.

The attribute 'alarmsCountSummary' provides a summary of the number of alarms managed in the Agent's alarm list (including the number of cleared but not yet acknowledged alarms).

The action 'getAlarmList' is the means, for the Manager, to trigger an alarm alignment procedure in accordance with the parameter specified in the action request (this may be needed e.g. for first time alignment or after a link interruption between the Agent and the Manager). The alarm list is sent as a sequence of single alarm reports.

The notification 'alarmListRebuilt' is sent by the Agent to the Manager to inform that the alarm list has changed. It is recommended that the Manager subsequently triggers an alarm alignment.";

5.2.2 alarmCountPackage

alarmCountPackage **PACKAGE**

BEHAVIOUR

alarmCountPackageBehaviour;

ACTIONS

getAlarmCount;

REGISTERED AS { ts32-111AlarmPackage 2};

alarmCountPackageBehaviour **BEHAVIOUR**

DEFINED AS

"This package has been defined to allow the Managers to get information from the Agent about the number of alarms currently present in the alarm list.";

5.2.3 alarmAcknowledgementPackage

alarmAcknowledgementPackage **PACKAGE**

BEHAVIOUR

alarmAcknowledgementPackageBehaviour;

ACTIONS

acknowledgeAlarms;

NOTIFICATIONS

"Rec. X.721 | ISO/IEC 10165-2 : 1992":communicationsAlarm,

"Rec. X.721 | ISO/IEC 10165-2 : 1992":environmentalAlarm,

"Rec. X.721 | ISO/IEC 10165-2 : 1992":equipmentAlarm,

"Rec. X.721 | ISO/IEC 10165-2 : 1992":processingErrorAlarm,

"Rec. X.721 | ISO/IEC 10165-2 : 1992":qualityofServiceAlarm;

REGISTERED AS { ts32-111AlarmPackage 3};

alarmAcknowledgementPackageBehaviour **BEHAVIOUR**

DEFINED AS

"This package has been defined to provide information to the Manager about the acknowledgement status of the alarms controlled by the Agent.

The action 'acknowledgeAlarms' allows the NM operator to acknowledge one or several alarms previously sent by the Agent as alarm notifications.

The ITU-T Recommendation X.721 [4] compliant alarm notifications are sent by the Agent to the Manager to inform that one alarm has been acknowledged. The acknowledgement related information is carried in the *additionalInformation* attribute.";

5.2.4 alarmUnacknowledgementPackage

alarmUnacknowledgementPackage **PACKAGE**

BEHAVIOUR

alarmUnacknowledgementPackageBehaviour;

ACTIONS

unacknowledgeAlarms;

REGISTERED AS { ts32-111AlarmPackage 4};

alarmUnacknowledgementPackageBehaviour **BEHAVIOUR**

DEFINED AS

"This package has been defined to provide the Manager with the capability to un-acknowledge alarms.

The action 'unacknowledgeAlarms' allows the NM operator to un-acknowledge one or several alarms previously acknowledged by him.

The ITU-T Recommendation X.721 [4] compliant alarm notifications are sent by the Agent to the Manager to inform that one alarm has been unacknowledged. The acknowledgement related information is carried in the *additionalInformation* attribute.";

5.2.5 alarmCommentPackage

alarmCommentPackage **PACKAGE**
BEHAVIOUR
 alarmCommentPackageBehaviour;
ACTIONS
 setComment;
NOTIFICATIONS
 notifyComments;
REGISTERED AS { ts32-111AlarmPackage 5};

alarmCommentPackageBehaviour **BEHAVIOUR**
DEFINED AS

"This package has been defined to allow the Operators to write comments about alarms that are in the alarm list of the IRP Agent.";

5.2.6 alarmIRPVersionPackage

alarmIRPVersionPackage **PACKAGE**
BEHAVIOUR
 alarmIRPVersionPackageBehaviour;
ATTRIBUTES
 supportedAlarmIRPVersions GET;
ACTIONS
 getAlarmIRPVersion;
REGISTERED AS { ts32-111AlarmPackage 6};

alarmIRPVersionPackageBehaviour **BEHAVIOUR**
DEFINED AS

"This package has been defined to allow the Manager to get information about the Alarm IRP versions supported by the Agent.

The attribute 'supportedAlarmIRPVersions' indicates all versions of the Alarm IRP currently supported by the Agent.

The action 'getAlarmIRPVersion' may be invoked by the Manager to get information about the Alarm IRP versions supported by the Agent. Such Alarm IRP versions must be compatible to each other. This means that the Manager may use any one of such Alarm IRP versions";

5.2.7 alarmProfilePackage

alarmProfilePackage **PACKAGE**
BEHAVIOUR
 alarmProfilePackageBehaviour;
ACTIONS
 getOperationProfile,
 getNotificationProfile;
REGISTERED AS { ts32-111AlarmPackage 7};

alarmProfilePackageBehaviour **BEHAVIOUR**
DEFINED AS

"This package has been defined to allow the Manager to get detailed information about the profile of Alarm IRP.

The action 'getOperationProfile' is invoked by the Manager to get detailed information about the operations supported by Alarm IRP.

The action 'getNotificationProfile' is invoked by the Manager to get detailed information about the notifications supported by Alarm IRP.";

5.2.8 alarmPotentialFaultyAlarmListPackage

alarmPotentialFaultyAlarmListPackage **PACKAGE**

BEHAVIOUR

alarmPotentialFaultyAlarmListPackageBehaviour;

NOTIFICATIONS

notifyPotentialFaultyAlarmList;

REGISTERED AS { ts32-111AlarmPackage 8};

alarmPotentialFaultyAlarmListPackageBehaviour **BEHAVIOUR**

DEFINED AS

"This package allows the IRPAgent to inform the IRPManager that the alarm list held by the IRPAgent might be faulty.";

5.3 Actions

5.3.1 acknowledgeAlarms (M)

acknowledgeAlarms **ACTION**

BEHAVIOUR

acknowledgeAlarmsBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .AckOrUnackAlarms;

WITH REPLY SYNTAX

TS32-111-4TypeModule .AckOrUnackAlarmsReply;

REGISTERED AS { ts32-111AlarmAction 1};

acknowledgeAlarmsBehaviour **BEHAVIOUR**

DEFINED AS

"This action is invoked by the Manager to indicate to the Agent that one or several alarms (previously sent by the Agent as alarm notifications) have to be acknowledged. In the action request the NM supplies the parameter *ackUserId* and *ackSystemId*. The other acknowledgement history parameters, i.e. alarm acknowledgement state (in this case *acknowledged*) and the acknowledgement time are set by the Agent itself.

The 'Action information' field contains the following data:

- *alarmReferenceList*

This parameter contains a set of MOI (Managed Object Instance) and *notificationIdentifier*. Each pair identifies unambiguously in the scope of the Agent an alarm (previously received by the NM) that have to be now acknowledged. MOI can be absent if scope of uniqueness of notificationIdentifier is across the IRPAgent.

- *ackUserId*

It contains the name of the operator who acknowledged the alarm or a generic name (dependent on the operational concept). It may have also the value NULL.

- *ackSystemId*

It indicates the management system where the acknowledgment is triggered. It may have also the value NULL.

The 'Action response' contains the following data:

- *status*

This parameter contains the results of the NM acknowledgement action. Possible values: noError (0, all alarms found and ack state changed according to the manager request), ackPartlySuccessful (some alarms not found / not changeable, see next parameter), error (value indicates the reason why the complete operation failed).

- *errorAlarmReferenceList*

This parameter (significant only if *status* = ackPartlySuccessful) contains the list of moi (managed object instance) and notificationIdentifier pairs of the alarms which could not be acknowledged and, for each alarm, also the reason of the error.";

5.3.2 getAlarmCount (O)

getAlarmCount **ACTION**

BEHAVIOUR

getAlarmCountBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .GetAlarmCount;

WITH REPLY SYNTAX

TS32-111-4TypeModule .GetAlarmCountReply;

REGISTERED AS { ts32-111AlarmAction 2};

getAlarmCountBehaviour **BEHAVIOUR**

DEFINED AS

"The NM invokes this action to receive the number of available alarms in the Agent' alarm list according to the specification in the action request. The Manager may use this action to find out the number of alarms in the alarm list before invoking a synchronisation by means of the *getAlarmList* operation. The request is possible also before the Manager creates an own event forwarding discriminator instance within the Agent.

The 'Action information' field contains the following data:

- *alarmAckState*

Depending on this optional parameter value, the NM gets the number of alarms of each *perceivedSeverity* value according to the following possible choices:

- all alarms
- all active alarms (acknowledged or not yet acknowledged)
- all active and acknowledged alarms
- all active and unacknowledged alarms
- all cleared and unacknowledged alarms.

If the parameter is absent, all alarms from the Agent's alarm list are taken into consideration.

- *filter*

The handling of this optional parameter is as follows:

- if present and not NULL, it indicates a filter constraint which shall apply in the calculation of the results
- if its value is NULL, no filter shall be considered and the Agent shall return the number of all alarms according to the value of the parameter *alarmAckState* (see above)
- if absent, the handling depends on the availability of an event forwarding discriminator instance within the Agent. If this instance is valid, the filter construct of the event forwarding discriminator shall apply. If no EFD instance is available, the Agent shall return the number of all alarms according to the value of the above-mentioned parameter *alarmAckState*.

The 'Action response' is composed of:

- The numbers of alarms for each *perceivedSeverity* value (if applicable).
- The parameter *status* containing the results of the NM action. Possible values: noError (0), error (the value indicates the reason of the error).";

5.3.3 getAlarmList (M)

getAlarmList **ACTION**

BEHAVIOUR

getAlarmListBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .GetAlarmList;

WITH REPLY SYNTAX

TS32-111-4TypeModule .GetAlarmListReply;

REGISTERED AS { ts32-111AlarmAction 3};

getAlarmListBehaviour **BEHAVIOUR**

DEFINED AS

"This action starts an alarm alignment procedure between a NM and Agent, which takes into account the acknowledgment state of the alarms and a dedicated filter (valid only for the current request).

The 'Action information' field contains the following data:

- *alarmAckState*

Depending on this optional parameter value, the NM gets the alarm reports according to the following possible choices:

- all alarms
- all active alarms (acknowledged or not yet acknowledged)
- all active and acknowledged alarms
- all active and unacknowledged alarms
- all cleared and unacknowledged alarms.

If the parameter is absent, all alarms from the Agent's alarm list are taken into consideration.

- *destination*

This parameter identifies the destination to which the alarm reports that have passed the test conditions specified in the parameter 'filter' are sent. According to ITU-T Recommendation X.721 [4], if no destination is specified in the request, then the discriminator is created with the destination defaulted to the AE-Title of the invoker.

- *filter*

The handling of this optional parameter (valid only for the current alignment request) is as follows:

- if present and not NULL, it indicates a filter constraint which shall apply in the forwarding of the alignment-related alarm reports
- if its value is NULL, no real filter shall be considered and the Manager receives the alarms according to the value of the parameter *alarmAckState* (see above).

The 'Action response' contains the following data:

- *alignmentId*

The parameter is defined by the Agent and identifies unambiguously the current alarm alignment procedure. It allows the Manager to distinguish between alarm reports sent as consequence of several own alignment requests triggered in parallel.

- *status*

The parameter contains the results of the NM action. Possible values: noError (0), error (the value indicates the reason of the error).

After the action response is forwarded to the NM, the Agent sends the alarm list as a sequence of single alarm notifications in accordance with the values of the request parameters. Every alarm notification contains all fields of the alarm stored in the alarm list. In particular:

- The field *additionalText* contains at the beginning a string to allow a Manager to recognise that this alarm report is sent due to a previous *getAlarmList* request. The structure of this string is:
 - '(ALIGNMENT-alignmentId)' for every alarm report except the last one **or**
 - '(ALIGNMENTEND-alignmentId)' for the last alarm report sent by the Agent due to the current *getAlarmList* request.
- If available, the data related to the acknowledgment history (i.e. *ackState*, *ackTime*, *ackUserId*, *ackSystemId*) are provided in the field *additionalInformation*.

Further details about the implementation of this operation are provided in the 'Introduction.';

5.3.4 setComment (O)

setComment **ACTION**

BEHAVIOUR

setCommentBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .SetComment;

WITH REPLY SYNTAX

TS32-111-4TypeModule .SetCommentReply;

REGISTERED AS { ts32-111AlarmAction 4};

setCommentBehaviour **BEHAVIOUR**

DEFINED AS

"The NM invokes this action to associate a comment to one or more alarms.

The 'Action information' field contains:

- *alarmReferenceList*
Contains a list of alarm identifiers to which the comment must be associated.
- *commentUserId*
Contains the identity of the User that invokes this operation.

- `commentSystemId`
Contains the identity of the NM that invokes this operation.
- `commentText`
Contains the text of the comment.

The 'Action response' is composed of the following data:

- `errorAlarmReferenceList`
List of pair of `alarmId` and failure reason.
- `status`
It contains the results of the NM action. Possible values: `actionSucceeded` (0), `actionPartiallyFailed` (12) or another value indicating the reason of the error.";

5.3.5 getAlarmIRPVersion (M)

`getAlarmIRPVersion` **ACTION**

BEHAVIOUR

`getAlarmIRPVersionBehaviour`;

MODE

CONFIRMED;

WITH REPLY SYNTAX

TS32-111-4TypeModule .GetAlarmIRPVersionReply;

REGISTERED AS { ts32-111AlarmAction 5};

`getAlarmIRPVersionBehaviour` **BEHAVIOUR**

DEFINED AS

"The NM invokes this action to get information about the Alarm IRP versions supported by the Agent.

The 'Action information' field contains no data.

The 'Action response' is composed of the following data:

- `versionNumbersList`

It defines a list of Alarm IRP versions supported by the Agent. A list containing no element, i.e. a NULL list means that the concerned Agent doesn't support any version of the Notification IRP.

- `status`

It contains the results of the NM action. Possible values: `noError` (0), `error` (the value indicates the reason of the error).";

5.3.6 getNotificationProfile (O)

`getNotificationProfile` **ACTION**

BEHAVIOUR

`getNotificationProfileBehaviour`;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule.IRPVersionNumber;

WITH REPLY SYNTAX

TS32-111-4TypeModule.GetNotificationProfileReply;

REGISTERED AS { ts32-111AlarmAction 6};

`getNotificationProfileBehaviour` **BEHAVIOUR**

DEFINED AS

"A Manager invokes this action to enquiry about the notification profile (supported notifications and supported parameters) for this specific Alarm IRP version.

The 'Action information' contains the following data:

- *irpVersionNumber*
This mandatory parameter identifies the Alarm IRP version.

The 'Action response' is composed of the following data:

- *notificationNameProfile*
It contains a list of notification names, i.e. a NULL list means that the Alarm IRP doesn't support any notification.
- *notificationParameterProfile*.
It contains a set of elements, each element corresponds to a notification name and is composed by a set of parameter names.
- *status*
It contains the results of this action. Possible values: noError (0), error (the value indicates the reason of the error).";

5.3.7 getOperationProfile (O)

getOperationProfile **ACTION**

BEHAVIOUR

getOperationProfileBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule.IRPVersionNumber;

WITH REPLY SYNTAX

TS32-111-4TypeModule.GetOperationProfileReply;

REGISTERED AS { ts32-111AlarmAction 7};

getOperationProfileBehaviour **BEHAVIOUR**

DEFINED AS

"A Manager invokes this action to enquiry about the operation profile (supported operations and supported parameters) for this specific Alarm IRP version.

The 'Action information' contains the following data:

- *irpVersionNumber*
This mandatory parameter identifies the Alarm IRP version.

The 'Action response' is composed of the following data:

- *operationNameProfile*
It contains a list of operation names.
- *operationParameterProfile*.
It contains a set of elements, each element corresponds to an operation name and is composed by a set of parameter names.
- *status*
It contains the results of this action. Possible values: noError (0), error (the value indicates the reason of the error).";

5.3.8 unacknowledgeAlarms (O)

unacknowledgeAlarms **ACTION**

BEHAVIOUR

unacknowledgeAlarmsBehaviour;

MODE

CONFIRMED;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .AckOrUnackAlarms;

WITH REPLY SYNTAX

TS32-111-4TypeModule .AckOrUnackAlarmsReply;

REGISTERED AS { ts32-111AlarmAction 8};

unacknowledgeAlarmsBehaviour **BEHAVIOUR**

DEFINED AS

"This action is used by the Manager to indicate to the Agent that one or several alarms (previously acknowledged) have to be unacknowledged. Subsequently the 'acknowledgement history' information of these alarms in the Agent's alarm list is completely removed (this operation may be used by operators in case of a previous acknowledgement by mistake).

The 'Action information' field contains the following data:

alarmReferenceList

This parameter contains a set of MOI (Managed Object Instance) and *notificationIdentifier pair*. Each of them identifies unambiguously in the scope of the Agent an alarm (previously acknowledged by the NM) that have to be now unacknowledged. MOI can be absent if scope of uniqueness of notificationIdentifier is across the IRPAgent.

- *ackUserId*

It contains the name of the operator who unacknowledged the alarm or a generic name (dependent on the operational concept). It may have also the value NULL. Note that only the user who previously acknowledged the alarm is allowed to un-acknowledge it later.

- *ackSystemId*

It indicates the management system where the acknowledgment is triggered. It may have also the value NULL. Note that the un-acknowledgement is allowed only at the management system where previously the acknowledgement took place.

The 'Action response' contains the following data:

- *status*

This parameter contains the results of the NM un-acknowledgement action. Possible values: noError (0, all alarms found and ack state changed according to the manager request), unackPartlySuccessful (some alarms not found / not changeable, see next response parameter), error (value indicates the reason why the complete operation failed).

- *errorAlarmReferenceList*

This parameter (significant only if *status* = unackPartlySuccessful) contains the list of MOI (Managed Object Instance) and notificationIdentifier pairs of the alarms which could not be unacknowledged and, for each alarm, also the reason of the error. MOI can be absent if scope of uniqueness of notificationIdentifier is across the IRPAgent. ";

5.4 Notifications

5.4.1 notifyAlarmListRebuilt (M)

alarmListRebuilt **NOTIFICATION**

BEHAVIOUR

alarmListRebuiltBehaviour;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .AlarmListRebuiltInfo;

REGISTERED AS { ts32-111AlarmNotification 1};

alarmListRebuiltBehaviour **BEHAVIOUR**
DEFINED AS

"This notification is used by the Agent to inform the NM that the alarm list has been rebuilt.

The 'Event Information' field contains the following data:

- *notificationIdentifier*

This ITU-T X.721 standardised parameter, together with MOI (Managed Object Instance), unambiguously identifies this notification.

- *rebuiltObjectClass*

This parameter carries the IRPAgent MOC when the entire AlarmList has been rebuilt. It carries a different MOC when the AlarmList has been partially rebuilt.

- *rebuiltObjectInstance*

This parameter carries DN of the IRPAgent when the entire AlarmList has been rebuilt. It carries the DN of another MOI when the AlarmList has been partially rebuilt and only the MOIs subordinate of this rebuilt MOI may be affected by this partial rebuilt.

- *reason*

The parameter indicates the reason for alarm list rebuilding (if applicable).";

- *alarmListAlignmentRequirement*

This parameter indicates, if the IRPManager has to align its alarm list with the IRPAgent. Absence of this parameter means, that an alignment is required.

5.4.2 notifyComments (O)

notifyComments **NOTIFICATION**
BEHAVIOUR

notifyCommentsBehaviour;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule .NotifyComments;

REGISTERED AS { ts32-111AlarmNotification 2};

notifyCommentsBehaviour **BEHAVIOUR**
DEFINED AS

"This notification is used by the Agent to inform the NM that one or more comments have been associated to one alarm.

The 'Event Information' field contains the following data:

- *alarmedObjectClass*

This parameter specifies the object class representing the resource that raised the alarm to which the comment was attached.

- *alarmedObjectInstance*

This parameter specifies the object instance representing the resource that raised the alarm to which the comment was attached.

- *notificationIdentifier*

This parameter specifies the notification identifier (ITU-T X.733 [5]), which, together with the instance of the object emitting this notification, unambiguously identifies this notification.

- *alarmEventTime*

This parameter specifies the time when the alarm, to which the comment was attached, was first raised by the alarmed resource.

- *alarmType*
This parameter specifies the event type of the notification that reported the alarm to which the comment was attached.
- *alarmProbableCause*
This parameter specifies the probable cause (ITU-T X.733 [5]) of the alarm to which the comment was attached.
- *alarmPerceivedSeverity*
This parameter specifies the perceived severity (ITU-T X.733 [5]) of the alarm to which the comment is attached.
- *comments*
This parameter carries the text of the comment.
";

5.4.3 notifyPotentialFaultyAlarmList (O)

notifyPotentialFaultyAlarmList **NOTIFICATION BEHAVIOUR**

notifyPotentialFaultyAlarmListBehaviour;

WITH INFORMATION SYNTAX

TS32-111-4TypeModule. NotifyPotentialFaultyAlarmListInfo

REGISTERED AS { ts32-111AlarmNotification 3};

notifyPotentialFaultyAlarmListBehaviour **BEHAVIOUR**

DEFINED AS

“This notification is used by the IRPAgent to inform the IRPManager that the IRPAgent has lost confidence in the integrity of its alarm list.

The ‘Event information’ field contains the following data:

- *potentialFaultyObjectClass*

This parameter specifies together with the parameter *potentialFaultyObjectInstance* the unreliable alarm information instances in the alarm list.

If this parameter carries the MOC of the IRPAgent, then the entire alarm list is unreliable.

If this parameter carries the MOC of another MO, then only a part of the alarm list is unreliable. The mechanism for identifying the unreliable part is described below.

- *potentialFaultyObjectInstance*

This parameter specifies together with the parameter *potentialFaultyObjectClass* the unreliable alarm information instances in the alarm list.

If *potentialFaultyObjectClass* carries the MOC of the IRPAgent, then this parameter carries the DN of the IRPAgent and the entire alarm list is unreliable.

If *potentialFaultyObjectClass* carries the MOC of another MO, then this parameter carries the DN of an instance of this class. All alarm information instances representing alarms raised by this MOI and its subordinates may be unreliable in this case.

- *notificationIdentifier*

This parameter specifies the notification identifier (ITU-T X.733 [5]), which, together with the instance of the object emitting this notification, unambiguously identifies this notification.

- *reason*

This parameter specifies the reason why the IRPAgent has lost confidence in the integrity of its alarm list and needs to rebuild it.

”;

5.5 Attributes

5.5.1 alarmControlld

alarmControlld **ATTRIBUTE**
WITH ATTRIBUTE SYNTAX
TS32-111-4TypeModule .GeneralObjectId;
MATCHES FOR
EQUALITY;
BEHAVIOUR
alarmControlldBehaviour;
REGISTERED AS { ts32-111AlarmAttribute 1};

alarmControlldBehaviour **BEHAVIOUR**
DEFINED AS
"This attribute names an instance of a 'alarmControl' object class.";

5.5.2 alarmsCountSummary

alarmsCountSummary **ATTRIBUTE**
WITH ATTRIBUTE SYNTAX
TS32-111-4TypeModule .AlarmsCountSummary;
MATCHES FOR
EQUALITY;
BEHAVIOUR
alarmsCountSummaryBehaviour;
REGISTERED AS { ts32-111AlarmAttribute 2};

alarmsCountSummaryBehaviour **BEHAVIOUR**
DEFINED AS
"This attribute indicates a summary of number of alarms managed in the Agent's alarm list sorted according to the perceived severity (including the number of cleared but not yet acknowledged alarms). Additionally the number of all currently active alarms is provided.";

5.5.3 supportedAlarmIRPVersions

supportedAlarmIRPVersions **ATTRIBUTE**
WITH ATTRIBUTE SYNTAX
TS32-111-4TypeModule . SupportedAlarmIRPVersions;
MATCHES FOR
EQUALITY;
BEHAVIOUR
supportedAlarmIRPVersionsBehaviour;
REGISTERED AS { ts32-111AlarmAttribute 3};

supportedAlarmIRPVersionsBehaviour **BEHAVIOUR**
DEFINED AS
"This attribute provides the information concerning the Alarm IRP versions currently supported by the Agent.";

5.6 Parameters

5.6.1 ackStateParameter

ackStateParameter **PARAMETER**
CONTEXT
TS32-111-4TypeModule .AlarmInfo.additionalInformation;

WITH SYNTAX

TS32-111-4TypeModule .AckState;

BEHAVIOUR

ackStateParameterBehaviour;

REGISTERED AS { ts32-111AlarmParameter 1};

ackStateParameterBehaviour **BEHAVIOUR**

DEFINED AS

"This parameter models the optional *additionalInformation* field of the alarm notification. If present, it informs the NM about the current acknowledgement state of the present alarm.";

5.6.2 ackSystemIdParameter

ackSystemIdParameter **PARAMETER**

CONTEXT

TS32-111-4TypeModule .AlarmInfo.additionalInformation;

WITH SYNTAX

TS32-111-4TypeModule .SystemId;

BEHAVIOUR

ackSystemIdParameterBehaviour;

REGISTERED AS { ts32-111AlarmParameter 2};

ackSystemIdParameterBehaviour **BEHAVIOUR**

DEFINED AS

"This parameter models the optional *additionalInformation* field of the alarm notification. If present, it informs the NM about the identifier of the management system where the present alarm has been acknowledged.";

5.6.3 ackTimeParameter

ackTimeParameter **PARAMETER**

CONTEXT

TS32-111-4TypeModule .AlarmInfo.additionalInformation;

WITH SYNTAX

TS32-111-4TypeModule .AckTime;

BEHAVIOUR

ackTimeParameterBehaviour;

REGISTERED AS { ts32-111AlarmParameter 3};

ackTimeParameterBehaviour **BEHAVIOUR**

DEFINED AS

"This parameter models the optional *additionalInformation* field of the alarm notification. If present, it informs the NM about the time the present alarm has been acknowledged by the Agent.";

5.6.4 ackUserIdParameter

ackUserIdParameter **PARAMETER**

CONTEXT

TS32-111-4TypeModule .AlarmInfo.additionalInformation;

WITH SYNTAX

TS32-111-4TypeModule.UserId;

BEHAVIOUR

ackUserIdParameterBehaviour;

REGISTERED AS { ts32-111AlarmParameter 4};

ackUserIdParameterBehaviour **BEHAVIOUR**

DEFINED AS

"This parameter models the optional *additionalInformation* field of the alarm notification. If present, it informs the NM about the identifier of the user who acknowledged the present alarm.";

6 ASN.1 definitions for Alarm IRP

```
TS32-111-4TypeModule {itu-t(0) identified-organization(4) etsi(0) mobileDomain(0) umts-Operation-
Maintenance(3) ts-32-111(111) part4(4) informationModel(0) asn1Module(2) version1(1)}
```

```
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
--EXPORTS everything
IMPORTS
```

```
NotificationIdentifier, Destination, EventTime, ProbableCause, PerceivedSeverity
FROM Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1}
```

```
AlarmInfo
FROM Notification-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 2}
```

```
CMISFilter, ObjectInstance, ObjectClass, EventTypeId
FROM CMIP-1 {joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3)};
```

```
baseNodeUMTS OBJECT IDENTIFIER ::= { itu-t (0) identified-organization (4) etsi (0) mobileDomain
(0)
umts-Operation-Maintenance (3) }
ts32-111Prefix OBJECT IDENTIFIER ::= { baseNodeUMTS ts-32-111(111)}
ts32-111Part4 OBJECT IDENTIFIER ::= { ts32-111Prefix part4(4)}
ts32-111-4InfoModel OBJECT IDENTIFIER ::= { ts32-111Part4 informationModel(0)}

ts32-111AlarmObjectClass OBJECT IDENTIFIER ::= { ts32-111-4InfoModel managedObjectClass(3)}
ts32-111AlarmPackage OBJECT IDENTIFIER ::= { ts32-111-4InfoModel package(4)}
ts32-111AlarmParameter OBJECT IDENTIFIER ::= { ts32-111-4InfoModel parameter(5)}
ts32-111AlarmAttribute OBJECT IDENTIFIER ::= { ts32-111-4InfoModel attribute(7)}
ts32-111AlarmAction OBJECT IDENTIFIER ::= { ts32-111-4InfoModel action(9)}
ts32-111AlarmNotification OBJECT IDENTIFIER ::= { ts32-111-4InfoModel action(10)}
```

```
-- Start of 3GPP SA5 own definitions
```

```
AckErrorList ::= SET OF ErrorInfo
```

```
AlarmReference ::= SEQUENCE
```

```
{
  moi ObjectInstance OPTIONAL, -- absent if scope of uniqueness of notificationId is across IRPagent
  notificationIdentifier NotificationIdentifier
}
```

```
AckOrUnackAlarms ::= SEQUENCE
```

```
{
  alarmReferenceList SET OF AlarmReference, -- ITU-T X.721
  ackUserId UserId,
  ackSystemId SystemId OPTIONAL
}
```

```
AckOrUnackAlarmsReply ::= SEQUENCE
```

```
{
  status ErrorCauses,
  errorAlarmReferenceList AckErrorList
}
```

```
AckState ::= ENUMERATED
```

```
{
  acknowledged (0),
  unacknowledged (1)
}
```

```
AckTime ::= GeneralizedTime
```

```
AlarmChoice ::= ENUMERATED
```

```
{
  allAlarms (0),
  allActiveAlarms (1),
  allActiveAndAckAlarms (2),
  allActiveAndUnackAlarms (3),
  allClearedAndUnackAlarms (4),
  allUnackAlarms (5)
}
```

```
AlarmsCountSummary ::= SEQUENCE
```

```
{
  activeAlarmsCount INTEGER, -- this is the sum of criticalCount, majorCount,
  minorCount, warningCount
  criticalCount INTEGER, -- and indeterminateCount
}
```



```

    majorCount          INTEGER,
    minorCount          INTEGER,
    warningCount        INTEGER,
    indeterminateCount  INTEGER,
    clearedCount        INTEGER
  }
AlarmListRebuiltInfo ::= SEQUENCE
  {
    notificationIdentifier  NotificationIdentifier, -- ITU-T X.721
    rebuiltObjectClass     ObjectClass,
    rebuiltObjectInstance  ObjectInstance,
    reason                  ErrorCauses
    alarmListAlignmentRequirement AlarmListAlignmentRequirement
  }
AlarmListAlignmentRequirement ::= ENUMERATED
  {
    alignmentRequired (0)      An alarm alignment is required.
    alignmentNotRequired (1)  An alarm alignment is not required.
  }

Comment ::= GraphicString
ErrorCauses ::= ENUMERATED
  {
    noError (0),      -- operation / notification successfully performed
    wrongFilter (1),  -- the value of the filter parameter is not valid
    wrongAlarmAckState (2), -- the value of the alarmAckState parameter (e.g. getAlarmCount) is not
    valid
    ackPartlySuccessful (3),  -- acknowledgment request partly successful
    unackPartlySuccessful (4), -- unacknowledgment request partly successful
    wrongAlarmReference (5),  -- alarm identifier used in the alarm reference list not found (e.g. in
    case of acknowledgement request)
    wrongAlarmReferenceList (6), -- the alarm reference list (e.g. in case of acknowledgement
    request) is empty or completely wrong
    alarmAlreadyAck (7),  -- alarm to be acknowledged is already in this state
    alarmAlreadyUnack (8), -- alarm to be acknowledged is already in this state
    wrongUserId (9),  -- the user identifier in the unacknowledgement operation is not the same as
    in the previous acknowledgementAlarms request
    wrongSystemId (10), -- the system identifier in the unacknowledgement operation is not the same as
    in the previous acknowledgementAlarms request
    alarmAckNotAllowed (11), -- current management system not allowed to acknowledge the alarm (e.g.
    due to acknowledgement competence rules)
    setCommentPartlySuccessful (12),  -- the setComment action partly successful (e.g. some alarmId
    are not in the alarmList)
    unspecifiedErrorReason (255)  -- operation failed, specific error unknown
  }
ErrorInfo ::= SEQUENCE
  {
    moi ObjectInstance OPTIONAL, -- absent if uniqueness of notificationIdentifier is across
    IRPagent
    notificationIdentifier  NotificationIdentifier, -- ITU-T X.721
    reason                  ErrorCauses
  }
GeneralObjectId ::= INTEGER
GetAlarmCount ::= SEQUENCE
  {
    alarmAckState          AlarmChoice OPTIONAL,
    filter                  CMISFilter OPTIONAL -- ITU-T X.711
  }
GetAlarmCountReply ::= SEQUENCE
  {
    criticalCount          INTEGER,
    majorCount             INTEGER,
    minorCount             INTEGER,
    warningCount           INTEGER,
    indeterminateCount     INTEGER,
    clearedCount           INTEGER,
    status                 ErrorCauses
  }
GetAlarmIRPVersionReply ::= SEQUENCE
  {
    versionNumberList      SupportedAlarmIRPVersions,
    status                 ErrorCauses
  }
GetAlarmList ::= SEQUENCE
  {
    alarmAckState          AlarmChoice OPTIONAL,
    destination            Destination,      -- ITU-T X.721
    filter                  CMISFilter OPTIONAL -- ITU-T X.711
  }

```

```

}
GetAlarmListReply ::= SEQUENCE
{
  alignmentId      INTEGER,
  status           ErrorCauses
}
GetNotificationProfileReply ::= SEQUENCE
{
  notificationNameProfile      NotificationList,
  notificationParameterProfile ParameterListOfList,
  status                       ErrorCauses
}

GetOperationProfileReply ::= SEQUENCE
{
  operationNameProfile      OperationList,
  operationParameterProfile ParameterListOfList,
  status                    ErrorCauses
}

IRPVersionNumber ::= GraphicString

NotificationList ::= SET OF NotificationName

NotificationName ::= GraphicString

NotifyComments ::= SEQUENCE
{
  alarmedObjectClass      ObjectClass,           -- ITU-T X.711
  alarmedObjectInstance   ObjectInstance,       -- ITU-T X.711
  notificationIdentifier   NotificationIdentifier, -- ITU-T X.721
  alarmEventTime          EventTime,           -- ITU-T X.721
  alarmType               EventTypeId,        -- ITU-T X.711
  alarmProbableCause      ProbableCause,       -- ITU-T X.721
  alarmPerceivedSeverity   PerceivedSeverity,   -- ITU-T X.721
  comments                SET OF Comment
}

NotifyPotentialFaultyAlarmListInfo ::= SEQUENCE
{
  potentialFaultyObjectClass      ObjectClass,           -- ITU-T X.711
  potentialFaultyObjectInstance   ObjectInstance,       -- ITU-T X.711
  notificationIdentifier           NotificationIdentifier, -- ITU-T X.721
  reason                          ReasonPotentialFaultyAlarmList
}

OperationList ::= SET OF OperationName

OperationName ::= GraphicString

ParameterList ::= SET OF ParameterName

ParameterListOfList ::= SET OF ParameterList

ParameterName ::= GraphicString

ReasonPotentialFaultyAlarmList ::= ENUMERATED
{
  communicationErrorNEAgent, (0) -- A communication error between a NE and the agent has occurred.
  agentRestart               (1) -- The agent has restarted and not yet updated its alarm list.
  indeterminate              (2) -- The reason could not be determined.
}

SetComment ::= SEQUENCE
{
  alarmReferenceList      SET OF AlarmReference,
  commentUserId           UserId,
  commentSystemId         SystemId,
  commentText             Comment
}

SetCommentReply ::= SEQUENCE
{
  badAlarmReferenceList   SET OF ErrorInfo,
  status                  ErrorCauses
}

SystemId ::= GraphicString

SupportedAlarmIRPVersions ::= SET OF IRPVersionNumber

```

```
UserId ::= GraphicString
```

```
END -- of module TS32-111-4TypeModule
```

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
Mar 2000	S_07	SP-000012	--	--	Approved at TSG SA #7 and placed under Change Control	2.0.0	3.0.0
Mar 2000	--	--	--	--	cosmetic	3.0.0	3.0.1
Jun 2000	S_08	SP-000254	005	--	Split of TS - Part 4: Alarm Integration Reference Point (IRP): CMIP Solution Set (SS)	3.0.1	3.1.0
Sep 2000	--	--	--	--	cosmetic	3.1.0	3.1.1
Jun 2001	S_12	SP-010282	001	--	Alarm IRP: CMIP SS Rel4 - Addition of feature. As SA5 had not reviewed this part, it is submitted to SA#12 for Information only.	3.1.1	--
Sep 2001	S_13	SP-010470	001	1	Addition of features	3.1.1	4.0.0
Dec 2001	S_14	SP-010640	003	--	Change of qualifier for setComment and notifyComment	4.0.0	4.1.0
Dec 2001	S_14	SP-010640	004	--	Addition of missing parameter in notifyComments	4.0.0	4.1.0
Mar 2002	S_15	SP-020028	005	--	Addition of "perceivedSeverity" as parameter to "acknowledgeAlarms" operation (CMIP SS)	4.1.0	4.2.0
Mar 2002	S_15	--	--	--	Automatic upgrade to Rel-5 (no Rel-5 CR)	4.2.0	5.0.0
Jun 2002	S_16	SP-020283	007	--	Correction of errors and ambiguities in the Parameter Mapping Tables and ASN.1 Definitions	5.0.0	5.1.0
Jun 2002	S_16	SP-020284	008	--	Addition of the parameter alarmListAlignmentRequirement to the notification notifyAlarmListRebuilt in the CMIP SS (32.111-4)	5.0.0	5.1.0
Jun 2002	S_16	SP-020284	009	--	Adding the notification notifyPotentialFaultyAlarmList in the CMIP SS (32.111-4)	5.0.0	5.1.0
Jun 2002	S_16	SP-020284	010	--	Introduction of SS (32.111-4) to IS (32.111-2) relation and correction of Foreword	5.0.0	5.1.0

History

Document history		
V5.0.0	March 2002	Publication
V5.1.0	June 2002	Publication