ETSI TS 132 111-2 V4.0.0 (2001-06)

Technical Specification

Universal Mobile Telecommunications System (UMTS);
Telecommunication Management;
Fault Management;
Part 2: Alarm Integration Reference Point:
Information Service Version 1
(3GPP TS 32.111-2 version 4.0.0 Release 4)

Reference

RTS/TSGS-0532111-2Uv4

Keywords

UMTS

ETSI

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Foreword

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The present document is part 2 of a multi-part TS covering the 3rd Generation Partnership Project: Technical Specification Group Services and System Aspects, as identified 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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Introduction

The present document is part of a set of TSs which describe the requirements and information model necessary for the Telecommunication Management (TM) of 3G systems. The TM principles and TM architecture are specified in 3GPP TS 32.101 [6] and 3GPP TS 32.102 [7].

A 3G system is composed of a multitude of Network Elements (NE) of various types and, typically, different vendors inter-operate in a co-ordinated manner in order to satisfy the network users' communication requirements.
The occurrence of failures in a NE may cause a deterioration of this NE's function and/or service quality and will, in severe cases, lead to the complete unavailability of the NE. In order to minimise the effects of such failures on the Quality Of Service (QOS) as perceived by the network users it is necessary to:

- detect failures in the network as soon as they occur and alert the operating personnel as fast as possible;
- isolate the failures (autonomously or through operator intervention), i.e. switch off faulty units and, if applicable, limit the effect of the failure as much as possible by reconfiguration of the faulty NE/adjacent NEs;
- if necessary, determine the cause of the failure using diagnosis and test routines; and,
- repair/eliminate failures in due time through the application of maintenance procedures.

This aspect of the management environment is termed "Fault Management" (FM). The purpose of FM is to detect failures as soon as they occur and to limit their effects on the network Quality of Service (QOS) as far as possible. The latter is achieved by bringing additional/redundant equipment into operation, reconfiguring existing equipment/NEs, or by repairing/eliminating the cause of the failure.

Fault Management (FM) encompasses all of the above functionalities except commissioning/decommissioning of NEs and potential operator triggered reconfiguration (these are a matter of Configuration Management (CM), see [13]).

FM also includes associated features in the Operations System (OS), such as the administration of alarm list, the presentation of operational state information of physical and logical devices/resources/functions, and the provision and analysis of the alarm and state history of the network.

1 Scope

The present document defines the Alarm Integration Reference Point (IRP) Information Service (IS), which addresses the alarm surveillance aspects of Fault Management (FM), applied to the N Interface.

The purpose of the AlarmIRP is to define an interface through which a “system” (typically a Network Element Manager or a Network Element) can communicate alarm information for its managed objects to one or several Manager Systems (typically Network Management Systems).

The Alarm IRP IS defines the semantics of alarms and the interactions visible across the reference point in a protocol neutral way. It defines the semantics of the operations and notifications visible in the IRP. It does not define the syntax or encoding of the operations, notifications and their parameters.

2 References

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

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

[1] ITU-T Recommendation Q821: “Stage 2 and Stage 3 description for the Q3 interface – Alarm surveillance”.

[2] ITU-T Recommendation X.733 (02/92): “Information technology - Open Systems Interconnection - Systems management: Alarm Reporting Function”.

[3] ITU-T Recommendation X.721: “Information Technology - Open Systems Interconnection - Structure Of Management Information: Definition Of Management Information”.

[4] GSM 12.11 version 6.2.0 Release 1997: “Fault management of the Base Station System (BSS)”.

[5] 3GPP TS 32.302: “Notification IRP: Information Service”.

[6] 3GPP TS 32.101: “3G Telecom Management principles and high level requirements”.

[7] 3GPP TS 32.102: “3G Telecom Management architecture”.

[8] 3GPP TS 32.300: “Name Convention for Managed Objects”.

[9] 3GPP TS 32.111-1: “3G Fault Management”.

[10] 3GPP TS 32.620-2: “Generic Network Resource Model (NRM)”.

[11] ITU-T Recommendation M.3100 (07/95): “Generic network information model”.

[12] ITU-T Recommendation X.720: “Management Information Model”.

[13] 3GPP TS 32.620-2 : “Generic Network Resources IRP : Network Resource Model”.

[14] 3GPP TS 32.312 : “Generic IRP Management : Information Service”.

[15] ITU-T Recommendation X.736: “...”.

3 Definitions and abbreviations

3.1 Definitions

In addition to the terms and definitions defined in 3GPP TS 32.111-1 [9], the following definitions apply to this document:

Event: It is an occurrence that is of significance to network operators, the NEs under surveillance and Network Management applications. Events do not have state.

IRPManager: defined in 3GPP TS 32.102 [7].

IRP document version number string: The IRP document version number (sometimes called "**IRPVersion**") string is used to identify a particular IRP solution set specification. It is derived using the following rule. Take the 3GPP document version number on the front page of the solution set specification, such as "3GPP TS 32.106-3 V3.2.0 (2000-12)". Discard the leading "3GPP TS ". Discard all characters after and including the last period. Eliminate leading and trailing spaces. Reduce multiple consecutive spaces with one space. Express the resultant in a string. Capitalised the string. For example, if the 3GPP document version number is "3GPP TS 32.106-3 V3.2.0 (2000-12)", then the IRP document version number shall be "32.106 V3.2".

Matching-Criteria-Attributes: It identifies a set of ITU-T Recommendation X.733 [2] defined attributes. Notifications carrying identical values for these attributes are considered to be carrying alarm information related to (a) the same network resource and (b) the same alarmed condition. The matching-criteria-attributes are: `objectInstance, eventType, probableCause and specificProblem`, if present.

Notification: It refers to the transport of events from `IRPAgent` to `IRPManager`. In this IRP, notifications are used to carry alarm information from `IRPAgent` to `IRPManager`.

`IRPAgent`: defined in 3GPP TS 32.102 [7].

3.2 Abbreviations

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

CCITT	The International Telegraph and Telephone Consultative Committee
CMIP	Common Management Information Protocol
DN	Distinguished Name
EM	Element Manager
IOC	Information Object Class
IRP	Integration Reference Point
ITU-T	International Telecommunication Union, Telecommunication Sector
MO	Managed Object
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NM	Network Manager
OS	Operations System
OSI	Open System Interconnection
RDN	Relative Distinguished Name
SS	Solution Set
UML	Unified Modelling Language

4 Basic aspects

4.1 Background

Integration Reference Points (IRPs) are the means within 3G Telecom Management (TM) for specifying interoperable points of information exchange between systems and applications.

3GPP TS 32.101 [6] and 32.102 [7] contain background and introductory information about the IRP concept.

4.2 System Overview

The following figures identify system contexts of this document in terms of implementations called `IRPAgent` and `IRPManager`.

"`IRPManager`" depicts a process that interacts with `IRPAgent` for the purpose of receiving alarms via this IRP. Examples of `IRPManager` can be Network Management Systems and Alarm viewing devices (such as a local craft terminal). `IRPAgent` implements and supports the Alarm IRP.
`IRPAgent` can be one Network Element (NE) (see figure 2) or it can be one Element Manager (EM) with one or more NEs (see figure 1). In the latter case, the interfaces (represented by a thick dotted line) between the EM and the NEs are not subject of this IRP. Whether EM and NE share the same hardware system is not relevant to this document either. By observing the interaction across the Alarm IRP, one cannot deduce if EM and NE are integrated in a single system or if they run in separate systems.

As indicated in figure 1 and figure 2, the subject document need to be complemented with the Notification IRP [5] (to allow `IRPManager` to subscribe to notifications issued by `IRPAgent` and (optionally) product-specific resource models describing the MOs maintained by the `IRPAgent`).

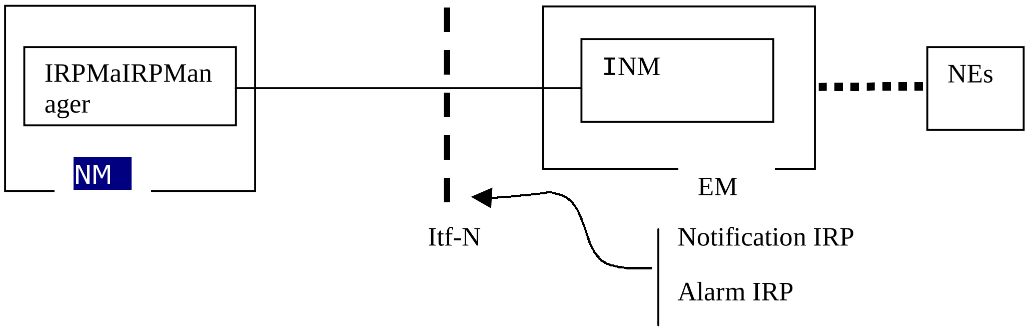


Figure 1: System Context A

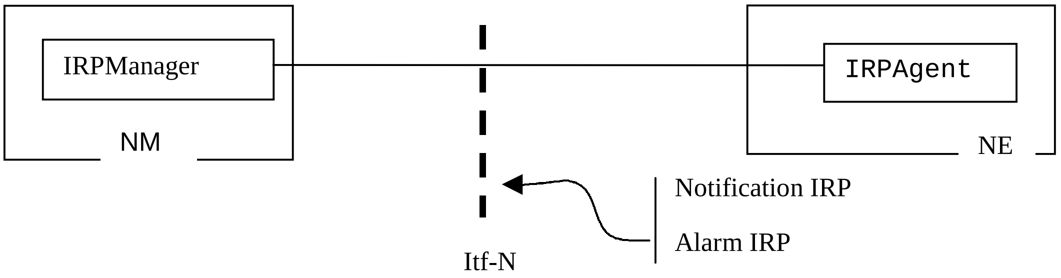


Figure 2: System Context B

5 Information Object Classes

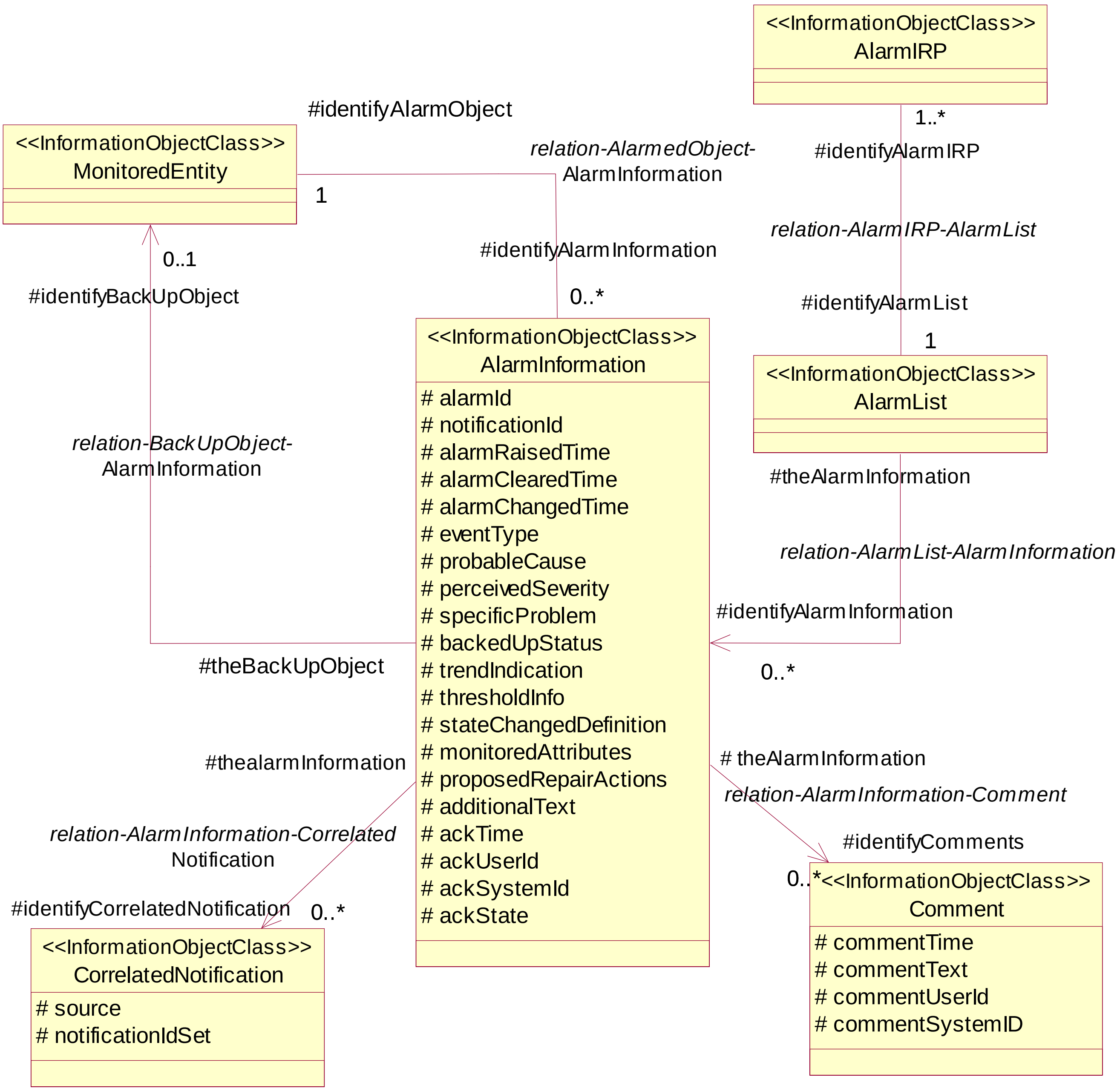
5.1 Information entities imported and local label

Label reference	**Local label**
32.302 [5], information object class, NotificationIRP	NotificationIRP
32.302 [5], interface, notificationIRPNotification	notificationIRPNotification
32.620-2 [10], information object class, IRPAgent	IRPAgent
32.620-2 [10], information object class, ManagedGenericIRP	ManagedGenericIRP

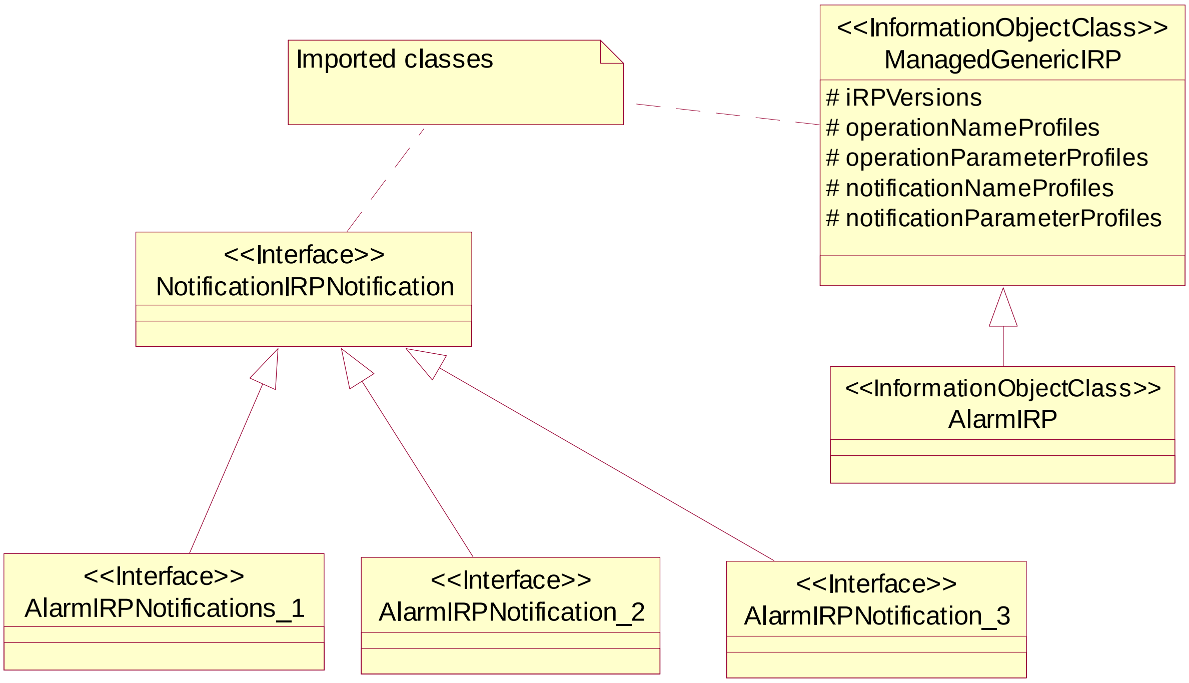
5.2 Class diagram

This sub-clause introduces the set of information object classes (IOCs) that encapsulate information within the IRPAgent. The intent is to identify the information required for the AlarmIRP Agent implementation of its operations and notification emission. This sub-clause provides the overview of all support object classes in UML. Subsequent sub-clauses provide more detailed specification of various aspects of these support object classes.

5.2.1 Attributes and relationships



5.2.2 Inheritance



5.3 Information Object Class Definitions

5.3.3 AlarmInformation

5.3.1.1 Definition

AlarmInformation contains information about alarm condition of an alarmed MonitoredEntity.

One IRPAgent is related to at most one AlarmList. The IRPAgent or its related AlarmIRP or the related AlarmList assigns an identifier, called alarmId, to each AlarmInformation in the AlarmList. An alarmId unambiguously identifies one AlarmInformation in the AlarmList.

5.3.1.2 Attribute

Attribute name	Support Qualifier
alarmId	M
notificationId (note 1)	M
alarmRaisedTime	M
alarmClearedTime	M
alarmChangedTime	O
eventType	M
probableCause	M
perceivedSeverity	M
specificProblem	O
backedUpStatus	O
trendIndication	O
thresholdInfo	O
stateChangedDefinition	O
monitoredAttributes	O
proposedRepairActions	O
additionalText	O

ackTime	M
ackUserId	M
ackSystemId	O
ackState	M

Note 1: This attribute may be "retired/removed" in Release 5 when Log IRP is introduced. Its removal implies that information carried in this attribute is no longer made accessible to IRPManager via the getAlarmList().

5.3.1.3 State diagram

Alarms have states. The alarm state information is captured in AlarmInformation in AlarmList.

The solid circle icon represents the Start State. The double circle icon represents the End State. In this state, the alarm is Cleared and acknowledged. The AlarmInformation shall not be accessible via the IRP and is removed from the AlarmList.

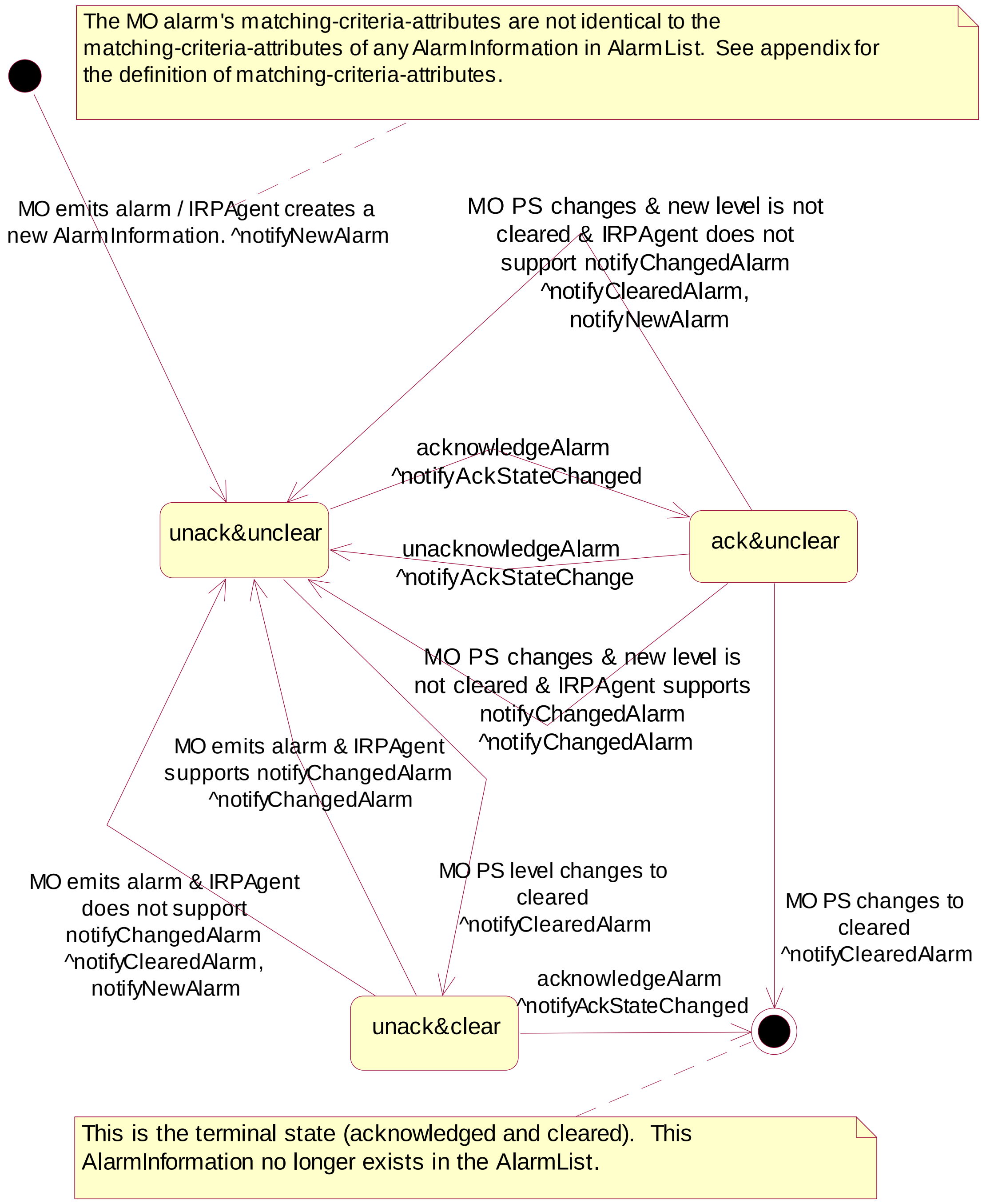
Note the state diagram uses " X / Y ^ Z " to label the arc that indicates state transition. The meanings of X, Y and Z are:

- X identifies the triggering event
- Y identifies the action of IRPAgent because of the triggering event
- Z is the notification to be emitted by IRPAgent because of the triggering event

Note that acknowledgeAlarm^notifyAckStateChanged and the unacknowledgeAlarm^notifyAckStateChange refer to cases when the request of the IRPManager is successful for the AlarmInformation concerned. They do not refer to the cases when the request is a failure since in the failure cases, no state transition would occur.

Note that, to reduce cluttering to the diagram, the setComment^notifyComment is not included in the figure. One transition should be applied from unack&unclear to itself. Similarly, another transition should be applied from ack&unclear to itself. Another one is from unack&clear to itself.

Note that "PS" used in the state diagram stands for "perceived severity".


The MO alarm's matching-criteria-attributes are not identical to the matching-criteria-attributes of any AlarmInformation in AlarmList. See appendix for the definition of matching-criteria-attributes.
MO emits alarm / IRPAgent creates a new AlarmInformation. ^notifyNewAlarm
MO PS changes & new level is not cleared & IRPAgent does not support notifyChangedAlarm ^notifyClearedAlarm, notifyNewAlarm
acknowledgeAlarm ^notifyAckStateChanged
unack&unclear
ack&unclear
unacknowledgeAlarm ^notifyAckStateChange
MO PS changes & new level is not cleared & IRPAgent supports notifyChangedAlarm ^notifyChangedAlarm
MO emits alarm & IRPAgent supports notifyChangedAlarm ^notifyChangedAlarm
MO emits alarm & IRPAgent does not support notifyChangedAlarm ^notifyClearedAlarm, notifyNewAlarm
MO PS level changes to cleared ^notifyClearedAlarm
MO PS changes to cleared ^notifyClearedAlarm
acknowledgeAlarm ^notifyAckStateChanged
unack&clear
This is the terminal state (acknowledged and cleared). This AlarmInformation no longer exists in the AlarmList.

5.3.2 AlarmList

5.3.2.1 Definition

IRPAgent maintains an AlarmList. It contains all currently active alarms (i.e. AlarmInformation whose perceivedSeverity is not Cleared) and alarms that are Cleared but not yet acknowledged.

5.3.2.2 Attribute

There is no additional attribute defined for this IOC besides those inherited.

5.3.3 AlarmIRP

5.3.3.1 Definition

AlarmIRP is the representation of the alarm management capabilities specified by this specification. This IOC inherits from ManagedGenericIRP IOC specified in [14].

5.3.4 Comment

5.3.4.1 Definition

Comment contains commentary and associated information such as the time when the commentary is made.

5.3.4.2 Attribute

Attribute Name	Support Qualifier
commentTime	M
commentText	M
commentUserId	M
commentSystemId	O

5.3.5 CorrelatedNotification

5.3.5.1 Definition

It identifies one MonitoredEntity. For that MonitoredEntity identified, a set of notification identifiers is also identified. One or more CorrelatedNotification instances can be related to an AlarmInformation. In this case, the information of the AlarmInformation is said to be correlated to information carried in the notifications identified by the CorrelatedNotification instances. See further definition of correlated notification in ITU-T Recommendation X.733 [2] clause 8.1.2.9.

The meaning of correlation is dependent on the type of notification itself. See the comment column of the correlatedNotification input parameter for each type of notification, such as notifyNewAlarm.

Notification carries AlarmInformation. The AlarmInformation instances referred to by the correlatedNotification may or may not exist in the AlarmList. For example, the AlarmInformation carried by the identified notification may have been acknowledged and Cleared and therefore, no longer exist in the AlarmList.

5.3.5.2 Attribute

Attribute Name	Support Qualifier
source	M
notificationIdSet	M

5.3.6 MonitoredEntity

5.3.6.1 Definition

It encapsulates a subset of information of an IOC that can emit alarms. It can also encapsulate a subset of information of an IOC that serves as the back up object.

5.3.6.2 Attribute

There is no attribute for this IOC.

5.4 Information relationships definition

5.4.1 relation-AlarmIRP-AlarmList (M)

5.4.1.1 Definition

This represents the relationship between AlarmIRP and AlarmList.

5.4.1.2 Role

Name	Definition
identifyAlarmIRP	It represents the capability to obtain the identities of one or more AlarmIRP.
identifyAlarmList	It represents the capability to obtain the identify of one AlarmList.

5.4.1.3 Constraint

There is no constraint for this relationship.

5.4.2 relation-AlarmList-AlarmInformation (M)

5.4.2.1 Definition

This represents the relationship between AlarmList and AlarmInformation.

5.4.2.2 Role

Name	Definition
theAlarmInformation	It represents the AlarmInformation.
identifyAlarmInformation	It represents a capability to obtain the information contained in AlarmInformation.

5.4.2.3 Constraint

Name	Definition
inv_ hasAlarmInformation1	No AlarmInformation playing the role of theAlarmInformation shall have its perceivedSeverity = “cleared” and its ackState = “acknowledged”.
inv_ hasAlarmInformation2	The alarmId of all AlarmInformation instances playing the role of theAlarmInformation are distinct.

5.4.3 relation-AlarmInformation-Comment (M)

5.4.3.1 Definition

This represents the relationship between AlarmInformation and Comment.

5.4.3.2 Role

Name	Definition
theAlarmInformation	It represents the AlarmInformation.
identifyComment	It represents a capability to obtain the information contained in Comment.

5.4.3.3 Constraint

There is no constraint.

5.4.4 relation-AlarmInformation-CorrelatedNotification (M)

5.4.4.1 Definition

This represents the relationship between AlarmInformation and CorrelatedNotification.

5.4.4.2 Role

Name	Definition
theAlarmInformation	It represents the AlarmInformation.
identifyCorrelatedNotification	It represents a capability to obtain the information contained in CorrelatedNotification.

5.4.4.3 Constraint

There is no constraint.

5.4.5 relation-AlarmedObject-AlarmInformation (M)

5.4.5.1 Definition

This represents the relationship between MonitoredEntity and AlarmInformation.

5.4.5.2 Role

Name	Definition
identifyAlarmedObject	It represents the capability to obtain the identification, in terms of objectClass and objectInstance, of alarmed network resource.
identifyAlarmInformation	It represents the capability to obtain the identities of AlarmInformation.

5.4.5.3 Constraint

Name	Definition
inv_relation-AI-ME	All AlarmInformation involved in this relationship with the same MonitoredEntity shall have at least one different value in the following attributes: eventType, probableCause and specificProblem.

5.4.6 relation-backUpObject-AlarmInformation (O)

5.4.6.1 Definition

The relationship represents the relationship between AlarmInformation and the backUpObject.

5.4.6.2 Role

Name	Definition
identifyBackUpObject	It represents a capability to obtain the identification, in terms of objectClass and objectInstance, of the backUpObject.

5.4.6.3 Constraint

Name	Definition
inv_identifyBackUpObject	This relationship is present if and only if the AlarmInformation.backedUpStatus attribute is present and is indicating true.

5.5 Information attribute definition

5.5.1 Definition and legal values

Name	Definition	Legal Values
alarmId	It identifies one AlarmInformation in the AlarmList.	
notificationId	It identifies the notification that carries the AlarmInformation.	
alarmRaised	It indicates the date and time when the alarm is first raised by	All values indicating valid time.

Name	Definition	Legal Values
Time	the alarmed resource.	
alarmChanged Time	It indicates the last date and time when the AlarmInformation is changed by the alarmed resource. Changes to AlarmInformation caused by invocations of the IRPManager would not change this date and time.	All values indicating valid time.
alarmCleared Time	It indicates the date and time when the alarm is Cleared.	All values indicating valid time.
eventType	It indicates the type of event. See Annex A for information on event type.	See Annex A.
probableCause	It qualifies alarm and provides further information than eventType. See Annex B for a complete listing.	See Annex B.
perceived Severity	It indicates the relative level of urgency for operator attention.	Critical, Major, Minor, Warning, Indeterminate, Cleared: see ITU-T Recommendation X.733 [2]. This IRP does not recommend the use of indeterminate.
specific Problem	It provides further qualification on the alarm than probableCause. This attribute value shall be single-value and of simple type such as integer or string. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.2.	Provided by vendor.
backedUp Status	It indicates if an object (the MonitoredEntity) has a back up. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.4.	All values that carry the semantics of backedUpStatus defined by ITU-T X.733 [2] clause 8.1.2.4.
trend Indication	It indicates if some observed condition is getting better, worse, or not changing.	“Less severe”, “no change”, “more severe”: see definition in ITU-T Recommendation X.733 [2] clause 8.1.2.6.
thresholdInfo	It indicates the direction of threshold crossing.	“Up direction”, “down direction”: see definitions in ITU-T Recommendation X.733 [2] clause 8.1.2.7.
stateChange Definition	It indicates MO attribute value changes. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.10.	
monitored Attributes	It indicates MO attributes whose value changes are being monitored. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.11.	
proposed RepairActions	It indicates proposed repair actions. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.12.	
additional Text	It carries semantics that is outside the scope of this IRP specification. It may provide the identity of the NE (e.g. RNC, Node-B) from which the alarm has been originated. It corresponds to the “user label” attribute of the object class representing the NE in the Generic Network Resource Model [10]. It can contain further information on the alarm.	N/A
ackTime	It identifies the time of last operation acknowledgeAlarms or unacknowledgeAlarms.	All values that indicate valid time that are later than that carried in alarmRaisedTime.

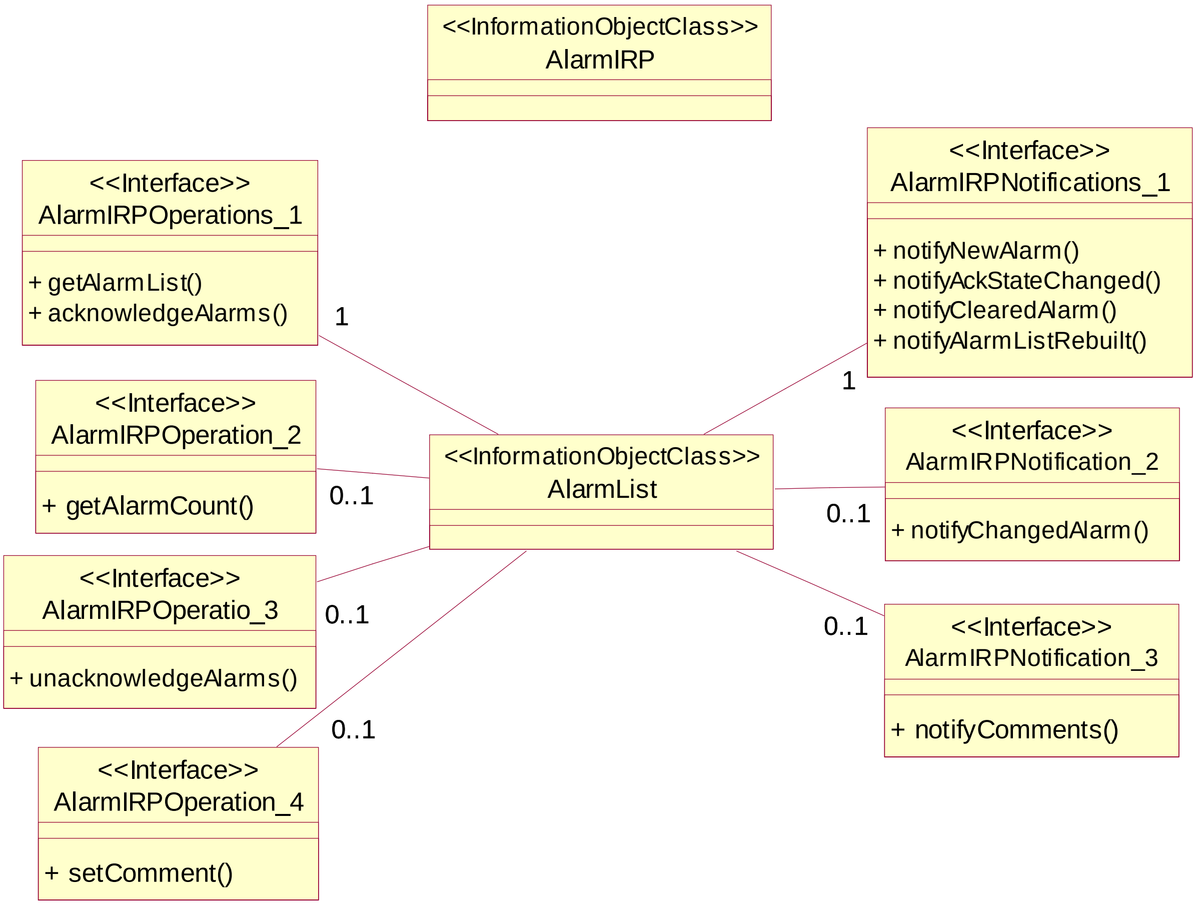
Name	Definition	Legal Values
ackUserId	It identifies the last user who has change the Acknowledgement State via operation acknowledgeAlarms or unacknowledgeAlarms. It can be used to identify the human operator such as “John Smith” or it can identify a group, such as “Team Six”, or it can contain no information such as “”.	N/A
ackSystemId	It identifies the system in which IRPManager, that invokes the acknowledgeAlarms or unacknowledgeAlarms operation, runs.	N/A
ackState	It identifies the Acknowledgement State of the alarm.	Acknowledged: the alarm has been acknowledged. Unacknowledged: the alarm has been unacknowledged or the alarm has never been acknowledged.
commentTime	It carries the time when a comment is made via setComment operation.	
commentText	It carries the textual comment made via setComment operation.	
commentUserId	It carries the identification of the user who made the comment via setComment operation.	
commentSystemId	It carries the identification of the system in which the the IRPManager runs. That IRPManager supports the user that made the comment.	
source	It identifies one MonitoredEntity.	All values that carry the semantics of DN.
notificationIdSet	It carries one or more notification identifiers.	

5.5.2 Constraints

Name	Definition
inv_alarmChangedTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_alarmClearedTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_ackTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_notificationId	NotificationIds shall be chosen to be unique across all notifications of a particular managed object (representing the NE) throughout the time that alarm correlation is significant. The algorithm by which alarm correlation is accomplished is outside the scope of this IRP.

6 Interface Definition

6.1 Class diagram



6.2 Generic rules

Rule 1: each operation with at least one input parameter supports a pre-condition valid_input_parameter which indicates that all input parameters shall be valid with regards to their information type. Additionally, each such operation supports an exception operation_failed_invalid_input_parameter which is raised when pre-condition valid_input_parameter is false. The exception has the same entry and exit state.

Rule 2: Each operation with at least one optional input parameter supports a set of pre-conditions supported_optional_input_parameter_xxx where "xxx" is the name of the optional input parameter and the pre-condition indicates that the operation supports the named optional input parameter. Additionally, each such operation supports an exception operation_failed_unsupported_optional_input_parameter_xxx which is raised when (a) the pre-condition supported_optional_input_parameter_xxx is false and (b) the named optional input parameter is carrying information. The exception has the same entry and exit state.

Rule 3: each operation shall support a generic exception operation_failed_internal_problem that is raised when an internal problem occurs and that the operation cannot be completed. The exception has the same entry and exit state.

6.3 Interface AlarmIRPOperations_1

6.3.1 acknowledgeAlarms (M)

6.3.1.1 Definition

The IRPManager invokes this operation to acknowledge one or more alarms.

6.3.1.2 Input Parameters

Name	Qualifier	Information Type	Comment
alarm Information ReferenceList	M	List of AlarmInformation.alarmId	It carries one or more identifiers identifying AlarmInformation instances in AlarmList.
AckUserId	M	AlarmInformation.ackUserId	It identities the user acknowledging the alarm.
ackSystemId	O	AlarmInformation.ackSystemId	It identifies the processing system on which the subject IRPManager runs. It may contain no information implying that IRPManager does not wish this information be kept in AlarmInformation in AlarmList.

6.3.1.3 Output Parameters

Name	Qualifier	Matching Information	Comment
badAlarm Information ReferenceList	M	List of pair of AlarmInformation.alarmId and failure reason.	If allAlarmsAcknowledged is true, it contains no information. If someAlarmAcknowledged is true, then it contains identifications of AlarmInformation that are (a) present in input parameter AlarmInformationReferenceList but are absent in the AlarmList; or (b) present in input parameter AlarmInformationReferenceList and are present in the AlarmList but the Acknowledgement Information (see note below table) has not changed, in contrast to IRPManager's request.
status	M	ENUM (OperationSucceeded, OperationFailed, OperationPartiallySucceeded)	If someAlarmAcknowledged is true, status = OperationPartiallySuceeded. If allAlarmsAcknowledged is true, status = OperationSucceeded. If operation_failed is true, status = OperationFailed.

Note: Acknowledgement Information is defined as the information contained in AlarmInformation.ackTime, AlarmInformation.ackUserId, AlarmInformaton.ackSystemId, AlarmInformation.ackState.

6.3.1.4 Pre-condition

atLeastOneValidId.

Assertion Name	Definition
atLeastOneValidId	The AlarmInformationReferenceList contains at least one identifier that identifies one AlarmInformation in AlarmList and that this identified AlarmInformation shall have its ackState indicating "unacknowledged".

6.3.1.5 Post-condition

someAlarmAcknowledged OR allAlarmsAcknowledged.

Assertion Name	Definition
someAlarmAcknowledged	At least one but not all AlarmInformation identified in input parameter AlarmInformationReferenceList has been acknowledged. Acknowledgement of an AlarmInformation means that the ackState attribute has been set to "acknowledged", that ackUserId, ackSystemId attributes of this AlarmInformation have been set to the values provided as input parameter and that the time of acknowledgeAlarms operation has been registered in ackTime attribute.
allAlarmsAcknowledged	All AlarmInformation identified in input parameter have been acknowledged. Acknowledgement of an AlarmInformation means that the ackState attribute has been set to "acknowledged", that ackUserId, ackSystemId attributes of this AlarmInformation have been set to the values provided as input parameter and that the time of acknowledgeAlarms operation has been registered in ackTime attribute.

6.3.1.6 Exceptions

Name	Definition
operation_failed	**Condition:** Pre-condition is false or post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.3.2 getAlarmList (M)

6.3.2.1 Definition

IRPManager requests IRPAgent to provide the list of AlarmInformation instances in AlarmList.

There are two modes of operation. One mode is synchronous. In this mode, the list of AlarmInformation instances in AlarmList is returned synchronously with the operation. The other mode is asynchronous. In this mode, the list of AlarmInformation instances is returned via notifications. In asynchronous mode of operation, the only information returned synchronously is the status of the operation. The mode of operation to be used is determined by means outside the scope of specification. To use asynchronous mode, the IRPManager must have established a subscription with the IRPAgent notificationIRP via the subscribe operation specified in [5].

6.3.2.2 Input Parameters

Name	Qualifier	Information Type	Comment
alarmAckState	O	ENUM (all alarms, all active alarms, all active and acknowledged alarms, all active and unacknowledged, all Cleared and unacknowledged alarms, all unacknowledged)	It carries a constraint. The IRPAgent shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList.
filter	O	N/A	It carries a filter constraint. The IRPAgent shall apply it

			on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList.

6.3.2.3 Output Parameters

Name	Qualifier	Matching Information	Comment
AlarmInformationList	M	List of AlarmInformation.	It carries AlarmInformation in AlarmList. Case when synchronous mode of operation is used: (a) The IRPAgent shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when constructing this output parameter. Case when asynchronous mode of operation is used (i.e., this output parameter is conveyed via notifications): (a) If the filter parameter is present, the IRPAgent shall apply the constraint when constructing this output parameter. Furthermore, if the alarmAckState constraint is present, the IRPAgent shall apply that constraint as well. The filter constraint, if any, that is currently active in the notification channel is not used for the construction of this output parameter. (b) If the filter parameter is absent, the IRPAgent shall apply the filter constraint currently active in the notification channel when constructing this output parameter. If the alarmAckState constraint is present, the IRPAgent shall apply that constraint as well.
status	M	ENUM (OperationSucceeded, OperationFailed)	If allAlarmInformationReturned is true, status = OperationSucceeded. If operation_failed is true, status = OperationFailed.

6.3.2.4 Pre-condition

There is no pre-condition.

6.3.2.5 Post-condition

allAlarmInformationReturned.

Assertion Name	Definition
allAlarmInformationReturned	All AlarmInformation that satisfy the constraints expressed in input parameters filter and alarmAckState and are present in the AlarmList at the moment of this operation invocation are returned. All AlarmInformation in AlarmList remains unchanged as the result of this operation.

6.3.2.6 Exceptions

Assertion Name	Definition
operation_failed	**Condition:** At least one input parameter is invalid or the pre-condition is false or the post-condition is not ture. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.4 Interface AlarmIRPOperation_2

6.4.1 getAlarmCount (O)

6.4.1.1 Definition

An IRPManager wishes to know the amount of AlarmInformation kept in the AlarmList. The IRPManager requests the counts via this operation. Possible usage is for IRPManager to find out the number of AlarmInformation in AlarmList before invoking getAlarmList operation.

6.4.1.2 Input Parameters

Name	Qualifier	Information Type	Comment
filter	O	N/A	It carries a filter constraint. The operation shall apply it when counting the AlarmInformation instances in AlarmList. Case when synchronous mode of operation is used for getAlarmList: (a) If this parameter is present, the operation shall count the AlarmInformation instances which satisfy both (a) this filter constraint and (b) the condition set by input parameter alarmAckState. (b) If this parameter is absent, the operation shall count all AlarmInformation instances that satisfy the condition set by input parameter alarmAckState. Case when asynchronous mode of operation is used for getAlarmList: (a) If this parameter is present, the operation shall count all AlarmInformation instances that satisfy this filter constraint and the condition set by input parameter alarmAckState. (b) If this parameter is absent, the operation shall count AlarmInformation instances that satisfy (a) the filter constraint currently active in the notification channel established between the IRPManager and the IRPAgent that is equipped with NotificationIRP capabilities and (b) the condition set by input parameter alarmAckState.
alarmAckState	O	ENUM (all alarms, all active alarms, all active and acknowledged alarms, all active and unacknowledged, all	It carries a constraint. The operation shall apply it on AlarmInformation instances in AlarmList when counting.

		cleared and unacknowledged alarms, all unacknowledged)	

6.4.1.3 Output Parameters

Name	Qualifier	Matching Information	Comment
criticalCount, majorCount, minorCount, warningCount, indeterminateCount, clearedCount	M	N/A	They carry the number of AlarmInformation in AlarmList that has the following properties. Case when synchronous mode of operation is used: (a) The operation shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when counting. Case when asynchronous mode of operation is used (i.e., this output parameter is conveyed via notifications): (a) If the filter parameter is present, the operation shall apply the constraint when counting. Furthermore, if the alarmAckState constraint is present, the operation shall apply that constraint as well. The filter constraint, if any, that is currently active in the notification channel is not used for the counting. (b) If the filter parameter is absent, the operation shall apply the filter constraint currently active in the notification channel when counting. If the alarmAckState constraint is present, the operation shall apply that constraint as well.
status	M	ENUM (OperationSucceeded, OperationFailed)	If allAlarmInformationCounted is true, status = OperationSucceeded. If operation_failed is true, status = OperationFailed.

6.4.1.4 Pre-condition

There are no pre-conditions.

6.4.1.5 Post-condition

allAlarmInformationCounted.

Assertion Name	Definition
allAlarmInformationCounted	All AlarmInformation that satisfy the constraints expressed in input parameters filter and alarmAckState and are present in the AlarmList at the moment of this operation invocation are counted and the result returned. All AlarmInformation in AlarmList remains unchanged as the result of this operation.

6.4.1.6 Exceptions

Name	Definition
operation_failed	**Condition:** the pre-condition is false or the post-condition is true. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.5 Interface AlarmIRPOperation_3

6.5.1 unacknowledgeAlarms (O)

6.5.1.1 Definition

IRPManager invokes this operation to remove acknowledgement information kept in one or more AlarmInformation instances.

6.5.1.2 Input Parameters

Name	Qualifier	Information Type	Comment
alarm InformationReferenceList	M	List of AlarmInformation.alarmId	It carries one or more identifiers identifying AlarmInformation in AlarmList.
ackUserId	M	AlarmInformation.ackUserId	It identities the user that invokes this operation.
ackSystemId	O	AlarmInformation.ackSystemId	It identifies the processing system on which the subject IRPManager runs.

6.5.1.3 Output Parameters

Name	Qualifier	Matching Information	Comment
badAlarmInformationReferenceList	M	List of pair of AlarmInformation.alarmId and the failure reason.	If allAlarmsUnacknowledged is true, it contains no information. If someAlarmUnacknowledged is true, then it contains identifications of AlarmInformation that are (a) present in input parameter AlarmInformationReferenceList but are absent in the AlarmList; or (b) present in input parameter AlarmInformationReferenceList and are present in the AlarmList but the Acknowledgement Information (see note below table) has not changed, in contrast to IRPManager's request.
status	M	ENUM (OperationSucceeded, OperationFailed, OperationPartiallySucceeded)	If someAlarmUnacknowledged is true, status = OperationPartiallySuceeded. If allAlarmsUnacknowledged is true, status = OperationSucceeded. If operation_failed is true, status = OperationFailed.

Note: Acknowledgement Information is defined as the information contained in AlarmInformation.ackTime, AlarmInformation.ackUserId, AlarmInformaton.ackSystemId and AlarmInformation.ackState.

6.5.1.4 Pre-condition

atLeastOneValidId AND validUserId&SystemId.

Assertion Name	Definition
atLeastOneValidId	The AlarmInformationReferenceList contains at least one identifier that identifies one AlarmInformation in AlarmList and that this identified AlarmInformation shall have its ackState indicating "acknowledged".
validUserId&SystemId	The values of ackUserId and ackSystemId attributes of the AlarmInformation must be the same as the ones provided as input parameters. The AlarmInformation is identified by the input parameter AlarmInformationReferenceList.

6.5.1.5 Post-condition

someAlarmUnacknowledged OR allAlarmsUnacknowledged.

Assertion Name	Definition
someAlarmUnacknowledged	At least one but not all AlarmInformation identified in input parameter alarmListReferenceList has been unacknowledged. This means that the ackState attribute has been set to "unacknowledged", that ackTime, ackUserId, ackSystemId attributes of this AlarmInformation have been set to containing no information.
allAlarmsUnacknowledged	All AlarmInformation identified in input parameter have been unacknowledged. This means that the ackState attribute has been set to "unacknowledged", that ackTime, ackUserId, ackSystemId attributes of this AlarmInformation have been set to contain no information.

6.5.1.6 Exceptions

Name	Definition
operation_failed	**Condition:** Pre-condition is false or post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.6 Interface AlarmIRPOperation_4

6.6.1 setComment (O)

6.6.1.1 Definition

The IRPManager invokes this operation to record a comment in one or more AlarmInformation instances in AlarmList.

6.6.1.2 Input Parameters

Name	Qualifier	Information Type	Comment
AlarmInformation ReferenceList	M	List of AlarmInformation.alarmId	It carries one or more identifiers identifying AlarmInformation instances in the AlarmList.
commentUserId	M	The Comment.commentUserId where Comment is involved in relation-AlarmInformation-Comment with an AlarmInformation.	
commentSystemId	O	The Comment.commentSystemId where Comment is involved in relation-AlarmInformation-Comment with an AlarmInformation.	
commentText	M	The comment.commentText where Comment is involved in relation-AlarmInformation-Comment with an AlarmInformation.	

6.6.1.3 Output Parameter

Name	Qualifier	Matching Information	Comment
badAlarm Information ReferenceList	M	List of pair of AlarmInformation.alarmId and the failure reason.	If allUpdated is true, it contains no information. If someUpdated is true, then it contains identifications of AlarmInformation that are not present in AlarmList or that they are present, but AlarmInformation.comments has not changed, in contrast to IRPManager's request.
Status	M	ENUM(Operation succeeded, Operation failed, Operation partially failed)	If allUpdated is true, then status = OperationSsucceeded. If someUpdated is true, then status = OperationPartiallyFailed. If exception operationFailed is raised, then status = OperationFailed.

6.6.1.4 Pre-condition

atLeastOneValidId.

Assertion Name	Properties
atLeastOneValid Id	The AlarmInformationReferenceList contains at least one identifier that identifies one AlarmInformation in AlarmList.

6.6.1.5 Post-condition

allUpdated OR someUpdated.

Assertion Name	Properties
allUpdated	The AlarmInformation.comment of all alarms identified by the input parameter AlarmInformationReferenceList has been updated. The input parameter commentText, commentUserId and commentSystemId are added to the AlarmInformation.comment. The time of the operation invocation is captured in the AlarmInformation.comment as well. To make it possible to add the new comment, the IRPAgent may remove one or more old comment previously held by AlarmInformation.comments.
someUpdated	The AlarmInformation.comment attribute of at least one but not all alarms identified by the input parameter AlarmInformationReferenceList has been updated. The input parameter commentText, commentUserId and commentSystemId are added to the AlarmInformation.comment. The time of the operation invocation is captured in the AlarmInformation.comment as well. To add a new Comment, it may be necessary to remove one or more old Comment instances being held. The commentTime of the removed Comment instances shall be older than that of the remaining Comment instances.

6.6.1.6 Exceptions

Name	Properties
operation_failed	**Condition:** the pre-condition is false or the post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.7 Interface AlarmIRPNotifications_1

This specification does not specify methods for IRPManager to detect alarm loss. The use of alarmId to detect alarm loss is an arrangement made between IRPAgent and IRPManager. This arrangement is outside the scope of this specification. For example, IRPAgent may use integer sequence (e.g. 1, 2, 3, 4, 5, …) as alarmId instances for its alarms. Based on this knowledge, IRPManager can detect alarm loss. This kind of arrangement may not be possible for all SS.

This specification does not specify how IRPAgent can determine if IRPManager has received alarms correctly. Not all SSs provide such capability.

This document does not specify methods for IRPManager and IRPAgent to recover alarm loss. The only mechanism recommended to deal with alarm loss is the use of getAlarmList operation. This document does not specify conditions under which IRPManager should invoke this operation.

6.7.1 notifyNewAlarm (M)

6.7.1.1 Definition

A new AlarmInformation has been added in the AlarmList. The subscribed IRPManager instances are notified of this fact if the added AlarmInformation satisfies the current filter constraint of their subscription.

6.7.1.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
objectInstance	M,F	MonitoredEntity.objectInstance where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	AlarmInformation.alarmRaisedTime	
systemDN	C,F	IRPAgent.systemDN where the IRPAgent is related to the AlarmIRP that is related to this AlarmList.	It carries the DN of the IRPAgent.
notificationType	M,F	“notifyNewAlarm”.	
probableCause	M,F	AlarmInformation.probableCause	
perceivedSeverity	M,F	AlarmInformation.perceivedSeverity	
alarmType	M, F	AlarmInformation.eventType	
specificProblem	O	AlarmInformation.specificProblem	
correlatedNotifications	O	The set of CorrelatedNotification related to this AlarmInformation.	
backedUpStatus	O	AlarmInformation.backedUpStatus	
backUpObject	O	MonitoredEntity.objectInstance where the MonitoredEntity is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation.	It carries the DN of the back up object.
trendIndication	O	AlarmInformation.trendIndication	
thresholdInfo	O	AlarmInformation.threshold	

Parameter Name	Qualifier	Matching Information	Comment
		Info	
stateChangeDefinition	O	AlarmInformation.stateChange	
monitoredAttributes	O	AlarmInformation.monitoredAttributes	
proposedRepairActions	O	AlarmInformaton.proposedRepairActions	
additionalText	O	AlarmInformation.additionalText	
alarmId	M	AlarmInformation.alarmId	

6.7.1.3 Triggering Event

6.7.1.3.1 From-state

noMatchedAlarm.

Assertion Name	Definition
noMatchedAlarm	AlarmList does not contain an AlarmInformation that has the following properties: • Its matching-criteria-attributes values are identical to that of the newly generated network alarm and • It is involved in relation-AlarmObject-AlarmInformation with the same MonitoredEntity as the one identified by the newly generated network alarm.

6.7.1.3.2 To-state

newAlarmInAlarmList.

Assertion Name	Definition
newAlarmInAlarmList	AlarmList contains an AlarmInformation holding information conveyed by the newly generated network alarm. This AlarmInformation is involved in relation-AlarmObject-AlarmInformation with the same MonitoredEntity as the one identified by the newly generated network alarm. The following attributes of the AlarmInformation shall be populated with information in the newly generated alarm. alarmId, notificationId, alarmRaisedTime, eventType, probableCause, perceivedSeverity. The following attributes of the same AlarmInformation shall be populated with information in the newly generated alarm if the information is present (in the newly generated alarm) and if the attribute is supported. specificProblem, backedUpStatus, trendIndication, thresholdInfo, stateChangedDefinition, monitoredAttributes, proposedRepairActions, additionalText.

6.7.2 notifyAckStateChanged (M)

6.7.2.1 Definition

The subscribed IRPManager instances are notified regarding changes in alarm Acknowledgement State. The AlarmInformation carried in the notification shall satisfy the current filter constraint of the subscription.

The notification shall contain all parameters that are filterable and are present in the original (related) notifyNewAlarm notification.

6.7.2.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the AlarmInformation.	
objectInstance	M,F	MonitoredEntity.objectInstance where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the AlarmInformation.	
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	AlarmInformation.ackTime	
systemDN	C,F	IRPAgent.systemDN	
notificationType	M,F	"notifyAckStateChanged"	
probableCause	M,F	AlarmInformation.probableCause	
perceived Severity	M,F	AlarmInformation.perceivedSeverity	
alarmType	M,F	AlarmInformation.eventType	
alarmId	M	AlarmInformation.alarmId	
ackTime	M	AlarmInformation.ackTime	
ackState	M	AlarmInformation.ackState	
ackUserId	M	AlarmInformation.ackUserId	
ackSystemId	O	AlarmInformation.ackSystemId	

6.7.2.3 Triggering Event

6.7.2.3.1 From-state

alarmInformationExists.

Assertion Name	Definition
alarmInformationExists	The AlarmInformation exists in AlarmList.

6.7.2.3.2 To-state

alarmAckStateHasChanged.

Assertion Name	Definition
alarmAckStateHasChanged	The AlarmInformation.ackState of the AlarmInformation identified by from-state assertion alarmInformationExists have been updated. Specifically, the following attributes of the subject AlarmInformation are updated. notificationId, ackTime, ackUserId, ackState, ackSystemId.

6.7.3 notifyClearedAlarm (M)

6.7.3.1 Definition

IRPAgent notifies The subscribed IRPManager is notified of alarm clearing if the subject AlarmInformation satisfies the optional filter constraint expressed in the subscribe operation.

The notification shall contain all parameters that are filterable and are present in the original (related) notifyNewAlarm notification.

6.7.3.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
objectInstance	M,F	MonitoredEntity.objectInstance where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	AlarmInformation.alarmClearedTime	
systemDN	C,F	IRPAgent.systemDN where the IRPAgent is related to the AlarmIRP that is related to this AlarmList.	
notificationType	M,F	"notifyClearedAlarm"	
probableCause	M,F	AlarmInformation.probableCause	
perceivedSeverity	M,F	AlarmInformation.perceivedSeverity	Its value shall indicate Cleared.
alarmType	M,F	AlarmInformation.eventType	
correlated Notifications	O	The set of CorrelatedNotification	It contains references to other AlarmInformation

Parameter Name	Qualifier	Matching Information	Comment
		related to this AlarmInformation.	instances whose perceivedSeverity levels are Cleared as well. In this way, perceivedSeverity level of multiple AlarmInformation instances can be Cleared by one notification.
alarmId	M	AlarmInformation.alarmId	

6.7.3.3 Triggering Event

6.7.3.3.1 From-state

alarmMatched AND alarmCleared.

Assertion Name	Definition
alarmMatched	The matching-criteria-attributes of the newly generated network alarm have values that are identical (matched) with ones in one AlarmInformation in AlarmList and the perceivedSeverity of the matched AlarmInformation is not Cleared.
alarmCleared	The perceivedSeverity of the newly generated network alarm is Cleared.

6.7.3.3.1 To-state

AlarmInformationCleared_1.

Assertion Name	Definition
AlarmInformationCleared_1	The following attributes of the subject AlarmInformation are updated. perceivedSeverity (updated to Cleared),alarmClearedTime.

6.7.4 notifyAlarmListRebuilt (M)

6.7.4.1 Definition

The IRPAgent or its related AlarmIRP maintains an AlarmList. They can lose confidence in the integrity of its AlarmList. Under this condition, IRPAgent or its related AlarmIRP or the related AlarmList shall invoke notifyAlarmListRebuilt notification after the AlarmList has been rebuilt.

The IRPAgent can also invoke notifyAlarmListRebuilt notification indicating that part of the AlarmList has been rebuilt. In this case, the notification carries the managed object (MO) instance indicating that the AlarmList only have been rebuilt for alarms concerning this MO and its subordinate MOs. Furthermore, this notification indicates that there is no rebuilt going on for superior MOs of this MO.

6.7.4.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	It carries the IRPAgent.objectClass or alternatively, the object class of another MO.	If it carries the IRPAgent.objectClass, then all AlarmInformation instances in the AlarmList may have been rebuilt. If it carries the object class of another MO, then all AlarmInformation instances related to the MO and its subordinate MOs may have been rebuilt. The AlarmInformation instances not related to the subject MO and its subordinate MOs are not subject to rebuilt.
objectInstance	M,F	It carries the IRPAgent.iRPAgentId or alternatively, the id of another MO.	If objectClass carries the IRPAgent.objectClass, then this parameter carries the RDN of the IRPAgent whose AlarmList has been rebuilt. If objectClass carries the object class of another MO, then this parameter carries the RDN of the MO instance indicating that the AlarmList only have been rebuilt for alarms concerning that MO and its subordinate MOs.
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	It carries the time when the IRPAgent has rebuilt the AlarmList successfully.	
systemDN	C,F	IRPAgent.systemDN where the IRPAgent is related to the AlarmIRP that is related to this AlarmList.	
notificationType	M,F	"notifyAlarmListRebuilt".	
reason	M	"indeterminate". Other values can be added.	It carries the reason why the IRPAgent has rebuilt the AlarmList.

6.7.4.3 Triggering Event

6.7.4.3.1 From-state

alarmListRebuilt.

Assertion Name	Definition
alarmListRebuilt	IRPAgent loses confidence in part or whole of its AlarmList. IRPAgent has initiated procedure to repair its AlarmList.

6.7.4.3.2 To-state

alarmListRebuilt_2.

Assertion Name	Definition
alarmListRebuilt_2	IRPAgent rebuilt the whole or part of AlarmList.

6.8 Interface AlarmIRPNotification_2

6.8.1 notifyChangedAlarm (O)

6.8.1.1 Definition

The subscribed IRPManager instances are notified regarding changes in AlarmInformation in AlarmList. This notification is only triggered by a change in perceivedSeverity attribute value (except to the value "Cleared"). The AlarmInformation carried in the notification shall satisfy the current filter constraint of the subscription.

The notification shall contain all parameters that are filterable and are present in the original (related) notifyNewAlarm notification.

6.8.1.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
objectInstance	M,F	MonitoredEntity.objectInstance where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.	
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	AlarmInformation.alarmChangedTime	
systemDN	C,F	IRPAgent.systemDN where the IRPAgent is related to the AlarmIRP that is related to this AlarmList.	
notificationType	M,F	"notifyChangedAlarm"	
probableCause	M,F	AlarmInformation.probableCause	
perceivedSeverity	M,F	AlarmInformation.perceivedSeverity	
alarmType	M,F	AlarmInformation.eventType	
alarmId	M	AlarmInformation.alarmId	

6.8.1.3 Triggering Event

6.8.1.3.1 From-state

alarmMatched AND alarmNotCleared AND alarmChanged.

Assertion Name	Definition
alarmMatched	The matching-criteria-attributes of the newly generated network alarm has values that are identical (matches) with ones in one AlarmInformation in AlarmList.
alarmNotCleared	The perceivedSeverity of the newly generated network alarm is not Cleared.
alarmChanged	The perceivedSeverity of the newly generated network alarm and of the matched AlarmInformation are different.

6.8.1.3.2 To-state

informationUpdate.

Assertion Name	Definition
informationUpdate	• The AlarmInformation identified in alarmMatched in from-state has been updated according to the following rules : perceivedSeverity is updated; • notificationId is updated; • alarmChangedTime is updated; • ackTime, ackUserId and ackSystemId are updated to contain no information; • ackState is updated to “unacknowledged”;

6.9 Interface AlarmIRPNotification_3

6.9.1 notifyComments (O)

6.9.1.1 Definition

The subscribed IRPManager instances are notified regarding to the addition of Comment, as a consequence of successful completion of setComment operation, in AlarmInformation instances in AlarmList. The AlarmInformation carried in the notification shall satisfy the current filter constraint of the subscription.

The notification shall contain all parameters that are filterable and are present in the original (related) notifyNewAlarm notification.

IRPAgent shall support this notification if it supports the operation setComment.

6.9.1.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M,F	MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the AlarmInformation.	
objectInstance	M,F	MonitoredEntity.objectInstance where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the AlarmInformation.	
notificationId	M	This carries the semantics of notification identifier.	
eventTime	M,F	AlarmInformation.alarmChangedTime	
systemDN	C,F	IRPAgent.systemDN	
notificationType	M,F	"notifyComments"	
alarmType	M,F	AlarmInformation.eventType	
probableCause	M,F	AlarmInformation.probableCause	
perceived Severity	M,F	AlarmInformation.perceivedSeverity	
comments	M	The set of Comment instances involved in relationship with this AlarmInformation.	
alarmId	M	AlarmInformation.alarmId	

6.9.1.3 Triggering Events

6.9.1.3.1 From-state

alarmInformationExists.

Assertion Name	Definition
alarmInformationExists	The AlarmInformation is in AlarmList.

6.9.1.3.2 To-state

commentInserted.

Assertion Name	Definition
commentInserted	One Comment has been created and it is involved in a relationship with the AlarmInformation identified by from-state assertion alarmInformationExists. The following attributes of the newly created Comment shall be populated. commentTime (set to setComment operation completion time), commentText, commentUserId and commentSystemId.

Annex A (normative): Event Types

This appendix lists and explains event types used by this document.

Event type is defined in 3GPP TS 32.302 [5]. The table below lists some of the event types referred to in this document.

Notification IRP: Information Service [5] defines a parameter called `notificationType` that shall be present in all notification. This document defines a parameter called `alarmType` that shall be present in all notifications carrying alarm information. Examples of the `notificationType` are "notification of new alarm", "notification of AlarmList rebuilt", "notification of alarm cleared", etc. Examples of the `alarmType` are the event types defined in table below.

This document also defines an attribute of `AlarmInformation` called `eventType`. The mapping of this `eventType` (internal attribute and not visible to `IRPManager`) to `notificationType` or `alarmType` (both visible to `IRPManager`) is defined in relevant sections of this document. The choice of using "`eventType`" is to keep the list of attributes of `AlarmList` unchanged (compared to Release 99). One can replace this `eventType` with two attributes, called `notificationType` and `alarmType` so that mapping of these two attributes to the externally visible parameters of the same name will be straight-forward.

It is noted that the `AlarmInformation.eventType` can capture more information than the ITU-T defined event types [2]. One example is "notification of alarm list rebuilt".

It is noted that the mapping of the IS `notificationType` and `alarmType` to CMIP's event type or CORBA `event_name` or other fields are specified in the respective SS documents.

TableA.1: Event Types

Event Types	Explanation
Communications Alarm	An alarm of this type is associated with the procedure and/or process required conveying information from one point to another (ITU-T Recommendation X.733 [2]).
Processing Error Alarm	An alarm of this type is associated with a software or processing fault (ITU-T Recommendation X.733 [2]).
Environmental Alarm	An alarm of this type is associated with a condition related to an enclosure in which the equipment resides (ITU-T Recommendation X.733 [2]).
Quality of Service Alarm	An alarm of this type is associated with degradation in the quality of a service (ITU-T Recommendation X.733 [2]).
Equipment Alarm	An alarm of this type is associated with an equipment fault (ITU-T Recommendation X.733 [2]).

Annex B (normative): Probable Causes

This appendix lists probable causes and their corresponding event types.

Sources of these probable causes are ITU-T Recommendation M.3100 [11], ITU-T Recommendation X.721 [3], ITU-T Recommendation X.733 [2], ITU-T Recommendation X.736 [15] and GSM 12.11 [4].

The list may be extended in the future, e.g. with UMTS-specific probable causes.

Table B.1: Probable Causes from ITU-T Recommendation M.3100 [11]

M.3100 Probable cause	Event type
Indeterminate	Unknown
Alarm Indication Signal (AIS)	Communications
Call Setup Failure	Communications
Degraded Signal	Communications
Far End Receiver Failure (FERF)	Communications
Framing Error	Communications
Loss Of Frame (LOF)	Communications
Loss Of Pointer (LOP)	Communications
Loss Of Signal (LOS)	Communications
Payload Type Mismatch	Communications
Transmission Error	Communications
Remote Alarm Interface	Communications
Excessive Bit Error Rate (EBER)	Communications
Path Trace Mismatch	Communications
Unavailable	Communications
Signal Label Mismatch	Communications
Loss Of Multi Frame	Communications
Back Plane Failure	Equipment
Data Set Problem	Equipment
Equipment Identifier Duplication	Equipment
External IF Device Problem	Equipment
Line Card Problem	Equipment
Multiplexer Problem	Equipment
NE Identifier Duplication	Equipment
Power Problem	Equipment
Processor Problem	Equipment
Protection Path Failure	Equipment
Receiver Failure	Equipment
Replaceable Unit Missing	Equipment
Replaceable Unit Type Mismatch	Equipment
Synchronisation Source Mismatch	Equipment
Terminal Problem	Equipment
Timing Problem	Equipment
Transmitter Failure	Equipment
Trunk Card Problem	Equipment
Replaceable Unit Problem	Equipment
Air Compressor Failure	Environmental
Air Conditioning Failure	Environmental
Air Dryer Failure	Environmental
Battery Discharging	Environmental
Battery Failure	Environmental
Commercial Power Failure	Environmental
Cooling Fan Failure	Environmental
Engine Failure	Environmental
Fire Detector Failure	Environmental
Fuse Failure	Environmental
Generator Failure	Environmental
Low Battery Threshold	Environmental
Pump Failure	Environmental

M.3100 Probable cause	Event type
Rectifier Failure	Environmental
Rectifier High Voltage	Environmental
Rectifier Low F Voltage	Environmental
Ventilation System Failure	Environmental
Enclosure Door Open	Environmental
Explosive Gas	Environmental
Fire	Environmental
Flood	Environmental
High Humidity	Environmental
High Temperature	Environmental
High Wind	Environmental
Ice Build Up	Environmental
Intrusion Detection	Environmental
Low Fuel	Environmental
Low Humidity	Environmental
Low Cable Pressure	Environmental
Low Temperature	Environmental
Low Water	Environmental
Smoke	Environmental
Toxic Gas	Environmental
Storage Capacity Problem	Processing error
Memory Mismatch	Processing error
Corrupt Data	Processing error
Out Of CPU Cycles	Processing error
Software Environment Problem	Processing error
Software Download Failure	Processing error

Table B.2: Probable Causes from ITU-T Recommendation X.721 [3] / ITU-T Recommendation X.733 [2]

X.733 Probable Cause	Event type
Adapter Error	Equipment
Application Subsystem Failure	Processing error
Bandwidth Reduction	Quality of service
Call Establishment Error	Communications
Communication Protocol Error	Communications
Communication Subsystem Failure	Communications
Configuration or Customizing Error	Processing error
Congestion	Quality of service
Corrupt Data	Processing error
CPU Cycles Limit Exceeded	Processing error
Data Set or Modem Error	Equipment
Degraded Signal	Communications
DTE-DCE Interface Error	Communications
Enclosure Door Open	Environmental
Equipment Malfunction	Equipment
Excessive Vibration	Environmental
File Error	Processing error
Fire Detected	Environmental
Flood Detected	Environmental
Framing Error	Communications
Heating or Ventilation or Cooling System Problem	Environmental
Humidity Unacceptable	Environmental
Input/Output Device Error	Equipment
Input Device Error	Equipment
LAN Error	Communications
Leak Detection	Environmental
Local Node Transmission Error	Communications
Loss of Frame	Communications
Loss of Signal	Communications
Material Supply Exhausted	Environmental
Multiplexer Problem	Equipment
Out of Memory	Processing error
Output Device Error	Equipment
Performance Degraded	Quality of service

X.733 Probable Cause	Event type
Power Problem	Equipment
Pressure Unacceptable	Environmental
Processor Problem	Equipment
Pump Failure	Environmental
Queue Size Exceeded	Quality of service
Receive Failure	Equipment
Receiver Failure	Equipment
Remote Node Transmission Error	Communications
Resource at or Nearing Capacity	Quality of service
Response Time Excessive	Quality of service
Re-transmission Rate Excessive	Quality of service
Software Error	Processing error
Software Program Abnormally Terminated	Processing error
Software Program Error	Processing error
Storage Capacity Problem	Processing error
Temperature Unacceptable	Environmental
Threshold Crossed	Quality of service
Timing Problem	Equipment
Toxic Leak Detected	Environmental
Transmit Failure	Equipment
Transmitter Failure	Equipment
Underlying Resource Unavailable	Processing error
Version Mismatch	Processing error

Table B.3: Probable Causes from GSM 12.11 [4]

GSM 12.11 Probable Cause	Event Type
A-bis to BTS interface failure	Equipment
A-bis to TRX interface failure	Equipment
Antenna problem	Equipment
Battery breakdown	Equipment
Battery charging fault	Equipment
Clock synchronisation problem	Equipment
Combiner problem	Equipment
Disk problem	Equipment
Equipment failure	Equipment
Excessive receiver temperature	Equipment
Excessive transmitter output power	Equipment
Excessive transmitter temperature	Equipment
Frequency hopping degraded	Equipment
Frequency hopping failure	Equipment
Frequency redefinition failed	Equipment
Line interface failure	Equipment
Link failure	Equipment
Loss of synchronisation	Equipment
Lost redundancy	Equipment
Mains breakdown with battery back-up	Equipment
Mains breakdown without battery back-up	Equipment
Power supply failure	Equipment
Receiver antenna fault	Equipment
Receiver Failure	Equipment
Receiver multicoupler failure	Equipment
Reduced transmitter output power	Equipment
Signal quality evaluation fault	Equipment
Timeslot hardware failure	Equipment
Transceiver problem	Equipment
Transcoder problem	Equipment
Transcoder or rate adapter problem	Equipment
Transmitter antenna failure	Equipment
Transmitter antenna not adjusted	Equipment
Transmitter failure	Equipment
Transmitter low voltage or current	Equipment
Transmitter off frequency	Equipment

GSM 12.11 Probable Cause	Event Type
Database inconsistency	Processing error
File system call unsuccessful	Processing error
Input parameter out of range	Processing error
Invalid parameter	Processing error
Invalid pointer	Processing error
Message not expected	Processing error
Message not initialised	Processing error
Message out of sequence	Processing error
System call unsuccessful	Processing error
Timeout expired	Processing error
Variable out of range	Processing error
Watch dog timer expired	Processing error
Cooling system failure	Environmental
External equipment failure	Environmental
External power supply failure	Environmental
External transmission device failure	Environmental
Fan failure	Environmental
High humidity	Environmental
High temperature	Environmental
Intrusion detected	Environmental
Low humidity	Environmental
Low temperature	Environmental
Smoke detected	Environmental
Excessive Error Rate	Quality of service
Reduced alarm reporting	Quality of service
Reduced event reporting	Quality of service
Reduced logging capability	Quality of service
System resources overload	Quality of service
Broadcast channel failure	Communications
Connection establishment error	Communications
Invalid message received	Communications
Invalid MSU received	Communications
LAPD link protocol failure	Communications
Local alarm indication	Communications
Remote alarm indication	Communications
Routing failure	Communications
SS7 protocol failure	Communications
Transmission error	Communications

Table 20 identifies probable causes that are defined by more than one standard. This is for information only.

Table B.4: Duplicated Probable Causes

Duplicated Probable Cause	GSM 12.11	X.721 X.733	M.3100	Event Type
Call Establishment Failure (X.721/X.733) Call Setup Failure (M.3100)		X	X	Communications
Degraded Signal		X	X	Communications
Framing Error		X	X	Communications
Loss of Frame		X	X	Communications
Loss of Signal		X	X	Communications
Equipment Failure (GSM 12.11) Equipment Malfunction (X.721/X.733)	X	X		Equipment
Multiplexer Problem		X	X	Equipment
Power Problem		X	X	Equipment
Processor Problem		X	X	Equipment
Receiver Failure	X	X	X	Equipment
Timing Problem		X	X	Equipment
Transmitter Failure	X	X	X	Equipment
Enclosure Door Open		X	X	Environmental
Fan Failure (GSM 12.11) Cooling Fan Failure (M.3100)	X		X	Environmental
Fire Detected (X.721/X.733) Fire (M.3100)		X	X	Environmental
Flood Detected (X.721/X.733) Flood (M.3100)		X	X	Environmental
High Humidity	X		X	Environmental
High Temperature	X		X	Environmental
Intrusion Detected (GSM 12.11) Intrusion Detection (X.736/M.3100)	X		X	Environmental
Low Humidity	X		X	Environmental
Low Temperature	X		X	Environmental
Pump Failure		X	X	Environmental
Smoke Detected (GSM 12.11) Smoke (M.3100)	X		X	Environmental
Storage Capacity Problem		X	X	Processing Error
Excessive Bit Error Rate (M.3100) Excessive Error Rate (GSM12.11)	X		X	
Corrupt Data		X	X	Processing Error

Annex C (informative): Examples of using `notifyChangedAlarm`

This annex describes a number of valid and invalid interactions governing the case when IRPAgent is reporting a specific fault of a particular network resource whose alarm severity level changes from, e.g. "Critical" to "Minor" and then to "Cleared".

In the following examples:

`ni`	is `notificationId`,
`moc`	is `managedObjectClass`,
`moi`	is `managedObjectInstance`,
`et`	is `eventType`,
`pc`	is `probableCause`,
`sp`	is `specificProblem`,
`ps`	is `perceivedSeverity` and
`ai`	is `alarmId`.

EXAMPLE 1: Valid sequence 1 to support the hypothetical case:

```
(1) NotifyNewAlarm

   (ni=1, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Critical)

(2) NotifyChangedAlarm

   (ni=2, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Minor)

(3) NotifyClearedAlarm

   (ni=3, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Cleared)
```

EXAMPLE 2: Valid sequence 2 to support the hypothetical case:

```
(1)  NotifyNewAlarm

   (ni=1, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Critical)

(2)  NotifyClearedAlarm

   (ni=2, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Cleared)
(3)  NotifyNewAlarm

   (ni=3, ai=Y, moc=A, moi=B, et=C, pc=D, sp=E, ps=Minor)

(4)  NotifyClearedAlarm
   (ni=4, ai=Y, moc=A, moi=B, et=C, pc=D, sp=E, ps=Cleared)
```

EXAMPLE 3: Invalid sequence 1 to support the hypothetical case:

```
(1) NotifyNewAlarm

    (ni=1, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Critical)

(2) NotifyChangedAlarm

    (ni=2, ai=Y, moc=A, moi=B, et=C, pc=D, sp=E, ps=Minor)

(3) NotifyClearedAlarm

    (ni=3, ai=Y, moc=A, moi=B, et=C, pc=D, sp=E, ps=Cleared)
```

Interaction (2) is illegal since it uses a different `ai` for the same alarm. It should use `ai=X` as in interaction (1).

EXAMPLE 4: Invalid sequence 2 to support the hypothetical case:

```
(1)  NotifyNewAlarm

   (ni=1, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Critical)

(2)  NotifyNewAlarm

   (ni=2, ai=X, moc=A, moi=B, et=C, pc=D, sp=E, ps=Minor)
```

Interaction (2) is illegal since it invokes notifyNewAlarm using same `ai` value. It should use `notifyChangedAlarm` with the same `ai` value.

Annex D (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-000250	004		Split of TS - Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)	3.0.1	3.1.0
Sep 2000	--	--	--		Cosmetic	3.1.0	3.1.1
Sep 2000	S_09	SP-000438	001		Correction of qualifier for SystemDN	3.1.1	3.2.0
Sep 2000	S_09	SP-000438	002		Addition of a missing constraint in acknowledgeAlarm operation	3.1.1	3.2.0
Dec 2000	S_10	SP-000520	003		Incorrect modifiable attributes	3.2.0	3.3.0
Dec 2000	S_10	SP-000520	004		Add acknowledgement information to getAlarmList result	3.2.0	3.3.0
Dec 2000	S_10	SP-000520	005		Identification of valid Event Types and Extended Event Types within Notifications	3.2.0	3.3.0
Dec 2000	S_10	SP-000520	006		A cleared Alarm shall be given perceived severity "Cleared" and nothing else	3.2.0	3.3.0
Dec 2000	S_10	SP-000520	007		Inconsistent behaviour for cleared not yet acknowledged alarms	3.2.0	3.3.0
Jun 2001	S_12	SP-010282	008		Alarm IRP: IS Rel4 - Addition of feature	3.3.1	4.0.0

History

Document history		
V4.0.0	June 2001	Publication