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Technical Specification

3rd Generation Partnership Project;

Technical Specification Group Services and System Aspects;

Telecommunication management;

Fault Management;

Part 2: Alarm Integration Reference Point (IRP):

Information Service (IS)

(Release 16)

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# Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

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3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project: Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

32.111-1 "Fault Management; Part 1: 3G fault management requirements".

**32.111-2 "Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".**

32.111-6 "Fault Management; Part 6: Alarm Integration Reference Point (IRP): Solution Set (SS) definitions.

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

A 3GPP 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 minimize 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 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).

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 Itf-N.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".

[2] ITU-T Recommendation X.733 (02/92): "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".

[3] ITU-T Recommendation X.721 (02/92): "Information Technology - Open Systems Interconnection -Structure of management information: Definition of management information".

[4] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

[5] 3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)".

[6] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[7] 3GPP TS 32.102: "Telecommunication management; Architecture".

[8] Void.

[9] 3GPP TS 32.111-1: "Telecommunication management; Fault Management; Part 1: 3G fault management requirements".

[10] Void.

[11] ITU-T Recommendation M.3100 (04/05): "Generic network information model".

[12] Void.

[13] Void.

[14] 3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management; Information Service (IS)".

[15] ITU-T Recommendation X.736 (01/92): "Information technology - Open Systems Interconnection - Systems Management: Security alarm reporting function".

[16] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[17] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[18] ETSI TS 101 251 V6.3.0 (1999-07): "Digital cellular telecommunications system (Phase 2+); Fault management of the Base Station System (BSS) (GSM 12.11 version 6.3.0 Release 1997) "

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 32.101 [6], 3GPP TS 32.102 [7], 3GPP TS 32.111-1 [9] , 3GPP TS 21.905 [16] and the following apply:

**active alarm:** an alarm that has not been cleared ( i.e. an alarm whose perceivedSeverity is not Cleared).

**Event:** Network occurrence which has significance for the management of an NE. Events do not have state.

**IRPAgent:** See 3GPP TS 32.150 [1].

**IRPManager:** See 3GPP TS 32.150 [1].

**IRP document version number string (IRPVersion):** See 3GPP TS 32.312 [14].

**Itf-N:** Management interface defined in 3GPP TS 32.101 [6] subclause 5.1.2.2 and 3GPP TS 32.102 [7] subclause 7.3.2.

**Matching-Criteria-Attributes:** which 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:** Information message originated below Itf-N..

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TS 32.101 [6], 3GPP TS 32.102 [7], 3GPP TS 32.111-1 [9] , 3GPP TS 21.905 [16] and the following apply . An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TS 32.101 [6], 3GPP TS 32.102 [7], 3GPP TS 32.111-1 [9] and 3GPP TS 21.905 [16], in that order.

DN Distinguished Name

EM Element Manager

FM Fault Management

IOC Information Object Class

IRP Integration Reference Point

IS Information Service

NE Network Element

NM Network Manager

OS Operations System

QoS Quality of Service

SS Solution Set

SupportIOC Support Information Object Class

TM Telecommunication Management

UML Unified Modelling Language

# 4 Basic aspects

## 4.1 Void

## 4.2 System Context

The general definition of the System Context for the present IRP is found in 3GPP TS 32.150 [1] subclause 4.7.  
In addition, the set of related IRP(s) relevant to the present IRP is shown in the two diagrams below.



Figure 1: System Context A



Figure 2: System Context B

# 5 Information Object Classes

## 5.1 Imported information entities and local labels

|  |  |
| --- | --- |
| Label reference | Local label |
| 32.302 [5], SupportIOC, NotificationIRP | NotificationIRP |
| 32.302 [5], interface, notificationIRPNotification | NotificationIRPNotification |
|  |  |
| 32.312 [14], SupportIOC, ManagedGenericIRP | ManagedGenericIRP |

## 5.2 Class diagram

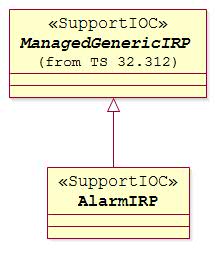
### 5.2.0 Introduction

This clause introduces the set of classes (i.e. IOCs, SupportIOCs) that encapsulate information within the AlarmIRP. The intent is to identify the information required for the AlarmIRP implementation of its operations and notification emission. This clause provides the overview of all support object classes in UML. Subsequent 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

### 5.3.1 AlarmInformation

#### 5.3.1.1 Definition

AlarmInformation contains information about alarm condition of an alarmed MonitoredEntity.

One AlarmIRP 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 | M |
| alarmRaisedTime | M |
| alarmClearedTime | M |
| alarmChangedTime | O |
| eventType | M |
| probableCause | M |
| perceivedSeverity | M |
| rootCauseIndicator | O |
| specificProblem | O |
| backedUpStatus | O |
| trendIndication | O |
| thresholdInfo | O |
| stateChangeDefinition | O |
| monitoredAttributes | O |
| proposedRepairActions | O |
| additionalText | O |
| additionalInformation | O(see note 4) |
| ackTime | M |
| ackUserId | M |
| ackSystemId | O |
| ackState | M |
| clearUserId | O (see note 2) |
| clearSystemId | O (see note 2) |
| serviceUser | O (see note 3) |
| serviceProvider | O (see note 3) |
| securityAlarmDetector | O (see note 3) |
| NOTE 1: Void.  NOTE 2: These attributes and qualifiers are applicable only if the IRPAgent supports clearAlarms() (they are absent if clearAlarms() is not supported).  NOTE 3: These attributes must be supported if the IRPAgent emits notifyNewAlarm that carries security alarm information.  NOTE 4: This attribute is optionally populated whenever vendor specific attributes are needed. A specific condition for this optional population is when an alarm presented by the EM (e.g. EM user interface) has different values of perceived severity, and / or alarm type, compared with the values presented to the Itf-N. | |

#### 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 AlarmIRP because of the triggering event

- Z is the notification to be emitted by AlarmIRP 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.

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

Figure A is used if it supports ^notifyChangedAlarm and Figure B is used if it does not support ^notifyChangedAlarm.



Figure A. ^notifyChangedAlarm supported



Figure B. ^notifyChangedAlarm not supported

### 5.3.2 AlarmList

#### 5.3.2.1 Definition

AlarmIRP maintains an AlarmList that contains 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 class besides those inherited.

### 5.3.3 AlarmIRP

#### 5.3.3.1 Definition

AlarmIRP is the representation of the alarm management capabilities specified by the present document. This class inherits from ManagedGenericIRP class specified in 3GPP TS 32.312 [14].

#### 5.3.3.2 Attribute

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

#### 5.3.3.3 Notification Table

| Name | Qualifier | Notes |
| --- | --- | --- |
| notifyAlarmListRebuilt | M | See 6.8.4. |
| notifyPotentialFaultyAlarmList | O | See 6.11.1. |

### 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 notification identified by the CorrelatedNotification, as defined in ITU-T and used here, can carry all types of information and not restricted to carrying alarm information only (see TS 32.302 [5]). For example, a notification, identified by the CorrelatedNotification, can indicate a managed instance attribute value change. In this case, the information of the AlarmInformation is said to be correlated to the managed instance attribute value change event.

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 represents classes that can have an alarmed state. The types of classes that can have alarmed state are:

a) All classes whose Notification Tables include alarm notifications.

b) VSE subclass of 3GPP defined classes and VSE defined classes that can have alarmed state.

The objectClass and objectInstance of this class identifies an instance of this class. The AlarmInformation uses this information in two places. In one place, the information is used to identify the instance that is in alarmed state. In another place, the information is used to identify an instance that can be used as the back up network resource for the instance that is in alarmed state.

#### 5.3.6.2 Attribute

There is no attribute for this class.

## 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

There is no role defined for this relationship.

#### 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 |
| 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 |
| comment | 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 |
| correlatedNotification | 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 |
| objectClass/objectInstance | It represents the capability to obtain the identification, in terms of objectClass and objectInstance, of alarmed network resource. |

#### 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 |
| backUpObject | 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. |  |
| alarmRaisedTime | It indicates the date and time when the alarm is first raised by the alarmed resource. | All values indicating valid time. |
| alarmChangedTime | 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. |
| alarmClearedTime | 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. |
| perceivedSeverity | 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. |
| specificProblem | 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. |
| backedUpStatus | 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. |
| trendIndication | 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 crossed threshold information such as:   * The identifier of the monitored attribute whose value has crossed a threshold, * The threshold settings, * The observed value that have crossed a threshold, etc.   See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.7. See also for information in TS 32.401 [4] subclause 5.6. |  |
| stateChangeDefinition | It indicates MO attribute value changes. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.10. |  |
| monitoredAttributes | It indicates MO attributes whose value changes are being monitored. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.11. |  |
| proposedRepairActions | It indicates proposed repair actions. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.12. |  |
| additionalText | 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 [17].  It can contain further information on the alarm. | N/A |
| additionalInformation | This attribute when present allows the inclusion of a set of vendor specific alarm information in the alarm.  A specific condition for this optional population is when an alarm presented by the EM (e.g. EM user interface) has different values of perceived severity, and / or alarm type, compared with the values presented to the Itf-N.  Any other uses of additional information on the alarm and its semantics is outside the scope of this IRP. | The additional information field is a list of one or more information parts.  This specification allows the support of two such information parts to carry   * vendor defined perceived severity * vendor defined alarm type   using defined identification.  Other vendor specific information parts are allowed by using vendor specific identifications. |
| ackTime | It identifies the time when the alarm has been acknowledged or unacknowledged the last time, i.e. it registers the time when ackState changes. | All values that indicate valid time that are later than that carried in alarmRaisedTime. |
| ackUserId | It identifies the last user who has changed the Acknowledgement State. | 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 "". |
| ackSystemId | It identifies the system (EM or NM) that last changed the ackState of an alarm, i.e. acknowledged or unacknowledged the alarm. | It can be used to identify the system, such as "system 6" or it can contain no information such as "". |
| 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 the comment has been added to the alarm. |  |
| commentText | It carries the textual comment. |  |
| commentUserId | It carries the identification of the user who made the comment. |  |
| commentSystemId | It carries the identification of the system (EM or NM) from which the comment is made. That system supports the user that made the comment. |  |
| rootCauseIndicator | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | “Yes”, “No” |
|  |  |  |
| source | It identifies one MonitoredEntity. | All values that carry the semantics of DN. |
| notificationIdSet | It carries one or more notification identifiers. |  |
| clearUserId | It carries the identity of the user who invokes the clearAlarms operation. | 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 "". |
| clearSystemId | It carries the identity of the system in which the IRPManager runs. That IRPManager supports the user who invokes the clearAlarms(). | It can be used to identify the system, such as "system 6" or it can contain no information such as "". |
| serviceUser | It identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm. | This attribute may carry no information if the server user is not identifiable. |
| serviceProvider | It identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm. |  |
| securityAlarmDetector | It carries the identity of the detector of the security alarm. | This attribute may carry no information if the security alarm detector is not identifiable. |

### 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 (M)

### 6.3.1 acknowledgeAlarms (M)

#### 6.3.1.1 Definition

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

The IRPManager may supply the identifier of the alarm and its perceivedSeverity. The reason for supplying the perceivedSeverity, in addition to the identifier of the alarm, is given in Annex E.

#### 6.3.1.2 Input Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Information Type | Comment |
| alarmInformationAndSeverityReferenceList | M | List of AlarmInformation.alarmId and AlarmInformation.perceivedSeverity | It carries one or more identifiers identifying AlarmInformation instances in AlarmList, including optionally the perceivedSeverity of the AlarmInformation instance that is going to be acknowledged.  alarm InformationAndSeverity ReferenceList  { alarmId - Mandatory;  perceivedSeverity - Optional  } |
| 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 be absent 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, ENUM (UnknownAlarmId, AcknowledgmentFailed, WrongPerceivedSeverity) and additional 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 = UnknownAlarmId; 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 = AcknowledgmentFailed; or  (c) present in input parameter AlarmInformationReferenceList and are present in the AlarmList but the perceivedSeverity to be acknowledged has changed and/or is different within the Alarm List = WrongPerceivedSeverity (applicable only if perceivedSeverity was provided). |
| 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" and, if provided, an equal perceivedSeverity. |

#### 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

The IRPManager invokes this operation to request the AlarmIRP to provide either the complete list of AlarmInformation instances in the AlarmList or only a part of this list (partial alarm alignment).

The parameters baseObjectClass and baseObjectInstance are used to identify the part of the alarm list to be returned. If they are absent, then the complete alarm list shall be provided (full alarm alignment). If they identify a particular class instance, then only a) the AlarmInformation instances related to this class instance and b) the AlarmInformation instances related to the subordinate class instances of this class instance shall be provided (partial alarm alignment). An instance-a is said to be subordinate to instance-b if the DN of the latter is part of the DN of the former.

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. A method allowing to abort an ongoing alarm alignment process shall be available in the asynchronous mode. 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 NotificationIRP via the subscribe operation specified in 3GPP TS 32.302 [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 AlarmIRP shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList. |
| baseObjectClass | O, see note 1 | This parameter is either absent or carries the object class of a certain class. | See how this attribute is used to support full alarm alignment and partial alarm alignment in 6.3.2.1.  See note 2. |
| baseObjectInstance | O, see note 1 | This parameter is either absent or carries the DN of a certain class instance. | See how this attribute is used to support full alarm alignment and partial alarm alignment in 6.3.2.1.  See note 2. |
| filter | O | N/A | It carries a filter constraint.  If the filter is present, the AlarmIRP shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList.  If the filter is not present, all of the AlarmInformation instances included by the scope are selected. |
| NOTE 1: If the notification notifyAlarmListRebuilt supports indicating that only a part of the alarm list has been rebuilt then the operation getAlarmList shall support partial alarm alignment.  NOTE 2: The legal values of the parameters baseObjectClass and baseObjectInstance are restricted to those carried by the parameters baseObjectClass and baseObjectInstance in the recent notifyAlarmListRebuilt notifications. The timeline for “recent” is vendor-specific. | | | |

#### 6.3.2.3 Output Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Information | Comment |
| alarmInformationList | M  For the Qualifier of the parameters in each list entry see the following table | List of AlarmInformation. | It carries the requested AlarmInformation instances.  Case when synchronous mode of operation is used:  (a) The AlarmIRP 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. |

The following table lists the set of sub-elements of the alarmInformationList attribute, and alarmInformationList forms a list of such sets.

| Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| notificationType | M | "notifyNewAlarm"  or  “notifyChangedAlarm”  or  “notifyClearedAlarm” | The parameter carries   * notifyNewAlarm in case the alarm has not yet changed and has not yet been cleared. * notifyChangedAlarm in case the alarm has changed but has not yet been cleared. * notifyClearedAlarm in case the alarm has been cleared but not yet acknowledged. |
| alarmType | M | AlarmInformation.eventType | This parameter indicates "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm" for non-security-related alarms.  It indicates "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation" or "Time Domain Violation” for security alarms. |
| objectClass, objectInstance | M | MonitoredEntity.objectClass where the MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.  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 | O | AlarmInformation.alarmRaisedTime or  AlarmInformation.alarmChangedTime or  AlarmInformation.alarmClearedTime | The parameter carries the   * alarmRaisedTime in case notificationType carries notifyNewAlarm * alarmChangedTime in case notificationType carries notifyChangedAlarm * alarmClearedTime in case notificationType carries notifyClearedAlarm   The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: An EMS is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| systemDN | C | See usage of this attribute in Notification header - see [5]. | Presence dependent on solution set.  See usage of this attribute in Notification header - see [5]. |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmRaisedTime | M | AlarmInformation.alarmRaisedTime | The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: An EMS is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| alarmChangedTime | O | AlarmInformation.alarmChangedTime | not applicable if the severity of related alarm was not changed  The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmChangedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: An EMS is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| alarmClearedTime | M | AlarmInformation.alarmClearedTime | not applicable if related alarm was not cleared  The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: An EMS is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |
| rootCauseIndicator | O | AlarmInformation.rootCauseIndicator |  |
| specificProblem | O | AlarmInformation.specificProblem |  |
| backedUpStatus | O | AlarmInformation.backedUpStatus | not applicable if related alarm is a security alarm |
| trendIndication | O | AlarmInformation.trendIndication | not applicable if related alarm is a security alarm |
| thresholdInfo | O | AlarmInformation.thresholdInfo | not applicable if related alarm is a security alarm |
| stateChangeDefinition | O | AlarmInformation.stateChange | not applicable if related alarm is a security alarm |
| monitoredAttributes | O | AlarmInformation.monitoredAttributes | not applicable if related alarm is a security alarm |
| proposedRepairActions | O | AlarmInformation.proposedRepairActions | not applicable if related alarm is a security alarm |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| ackTime | M | AlarmInformation.ackTime | not applicable if related alarm was not acknowledged nor unacknowledged  The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: An EMS is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| ackUserId | M | AlarmInformation.ackUserId | not applicable if related alarm was not acknowledged nor unacknowledged |
| ackSystemId | O | AlarmInformation.ackSystemId | not applicable if related alarm was not acknowledged nor unacknowledged |
| ackState | M | AlarmInformation.ackState | not applicable if related alarm was not acknowledged nor unacknowledged |
| clearUserId | O | AlarmInformation.clearUserId | not applicable if related alarm was not cleared |
| clearSystemId | O | AlarmInformation.clearSystemId | not applicable if related alarm was not cleared |
| backUpObject | O | MonitoredEntity.objectInstance where the MonitoredEntity is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation. | not applicable if related alarm is a security alarm |
| correlatedNotifications | O | The set of CorrelatedNotification related to this AlarmInformation. |  |
| comments | M | The set of Comment instances involved in a relationship with this AlarmInformation. | not applicable if the related alarm has no appended comments |
| serviceUser | M | AlarmInformation.serviceUser | not applicable if related alarm is not a security alarm |
| serviceProvider | M | AlarmInformation.serviceProvider | not applicable if related alarm is not a security alarm |
| securityAlarmDetector | M | AlarmInformation.securityAlarmDetector | not applicable if related alarm is not a security alarm |

#### 6.3.2.4 Pre-condition

baseObjectExists

|  |  |
| --- | --- |
| Assertion Name | Definition |
| baseObjectExists | If the parameters baseObjectClass and baseObjectInstance are provided the object identified by them has to exist.  If they are not provided this pre-condition is not applicable. |

#### 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 true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |
| filter\_complexity\_limit | **Condition:** Operation not performed because the filter parameter was too complex.  **Returned Information**: The output parameter status.  **Exit state:** Entry state. |

## 6.4 Interface AlarmIRPOperation\_2 (O)

### 6.4.1 getAlarmCount (M)

#### 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 cleared and unacknowledged alarms, all unacknowledged) | It carries a constraint. The operation shall apply it on AlarmInformation instances in AlarmList when counting. |

#### 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. |
| filter\_complexity\_limit | **Condition:** Operation not performed because the filter parameter is too complex.  **Returned Information**: The output parameter status.  **Exit state:** Entry state. |

## 6.5 Interface AlarmIRPOperation\_3 (O)

### 6.5.1 unacknowledgeAlarms (M)

#### 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 |
| alarmInformationReferenceList | 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 = OperationPartiallySucceeded.  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 (O)

### 6.6.1 setComment (M)

#### 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 = OperationSucceeded.  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 |
| atLeastOneValidId | 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 AlarmIRPOperation\_5 (O)

### 6.7.1 clearAlarms (M)

#### 6.7.1.1 Definition

The IRPManager invokes this operation to clear one or more AlarmInformation instances in AlarmList. For example, this operation can be used to support the manual clearing of the ADMC (automatic detection and manual clearing, see also 3GPP TS 32.111-1 [9]) alarms.

#### 6.7.1.2 Input Parameter

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Information Type | Comment |
| alarmInformation ReferenceList | M | List of AlarmInformation.alarmId | It carries one or more identifiers identifying AlarmInformation instances in the AlarmList. |
| clearUserId | M | AlarmInformation.clearUserId | It identities the user clearing the alarm. |
| clearSystemId | O | AlarmInformation.clearSystemId | It identifies the processing system on which the subject IRPManager runs. It may be absent implying that IRPManager does not wish this information be known to the IRPAgent. |

#### 6.7.1.3 Output Parameter

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Information | Comment |
| badAlarmInformation ReferenceList | M | List of pair of AlarmInformation.alarmId and the failure reason. | If allCleared is true, it contains no information.  If someCleared is true, then it contains identifications of AlarmInformation that are not present in AlarmList or that are present in AlarmList but remain unchanged, in contrast to IRPManager's request. |
| status | M | ENUM( OperationSucceeded, OperationFailed, OperationPartiallySucceeded) | If allCleared is true, then status = OperationSucceeded.  If someCleared is true, then status = OperationPartiallySucceeded.  If exception operationFailed is raised, then status = OperationFailed. |

#### 6.7.1.4 Pre-condition

atLeastOneValidId.

|  |  |
| --- | --- |
| Assertion Name | Properties |
| atLeastOneValidId | The input parameter alarmInformationReferenceList contains at least one identifier that identifies one AlarmInformation in AlarmList. |

#### 6.7.1.5 Post-condition

allCleared OR someCleared.

|  |  |
| --- | --- |
| Assertion Name | Properties |
| allCleared | The AlarmInformation.perceivedSeverity of all instances identified by the input parameter alarmInformationReferenceList are set to 'cleared'. The AlarmInformation.clearUserId and AlarmInformation.clearSystemId of all instances identified are set with values carried by input parameters clearUserId and clearSystemId respectively. |
| someCleared | It has the same properties as allCleared except that it is applicable to one or more but not all instances identified by the input parameter alarmInformationReferenceList. |

#### 6.7.1.6 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. |

## 6.8 Notification AlarmIRPNotifications\_1 (M)

### 6.8.0 Introduction

The present document 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. The use of such arrangement is outside the scope of the present document. 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.

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

The present 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. The present document does not specify conditions under which IRPManager should invoke this operation.

The filter qualifiers in tables listing input parameters of notifications only refer to applying a filter constraint to that notification. In other words: The filter qualifiers Y(es)/N(o) specify if the input parameter can be used or not when constructing the input parameter filter of operations subscribe or changeSubscriptionFilter defined in 3GPP TS 32.302 [5].

### 6.8.1 notifyNewAlarm (M)

#### 6.8.1.1 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.

There are two tables for Input Parameters. If alarmType parameter indicates "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm", the first table (see clause 6.8.1.2) shall be applicable for this notifyNewAlarm. If alarmType parameter indicates "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation" or "Time Domain Violation", the second table (see clause 6.8.1.3) shall be applicable.

#### 6.8.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | Notification header - see [5]. It shall carry the MonitoredEntity class name. The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | Notification header - see [5]. It shall carry the DN of the MonitoredEntity. The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| notificationId | M,N | -- | Notification header - see [5]. |
| eventTime | M,Y | AlarmInformation.alarmRaisedTime | Notification header - see [5]. |
| systemDN | C,Y | -- | Notification header - see [5]. |
| notificationType | M,Y | "notifyNewAlarm". |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity |  |
| rootCauseIndicator | O,N | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | “Yes”, “No” |
| alarmType | M,Y | AlarmInformation.eventType | The notification structure defined by this table is applicable if this parameter indicates "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm". |
| specificProblem | O,N | AlarmInformation.specificProblem |  |
| correlatedNotifications | O,N | The set of CorrelatedNotification related to this AlarmInformation. |  |
| backedUpStatus | O,N | AlarmInformation.backedUpStatus |  |
| backUpObject | O,N | MonitoredEntity.objectInstance | It carries the DN of the back up object. The object is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation. |
| trendIndication | O,N | AlarmInformation.trendIndication |  |
| thresholdInfo | O,N | AlarmInformation.thresholdInfo |  |
| stateChangeDefinition | O,N | AlarmInformation.stateChangeDefinition |  |
| monitoredAttributes | O,N | AlarmInformation.monitoredAttributes |  |
| proposedRepairActions | O,N | AlarmInformaton.proposedRepairActions |  |
| additionalText | O,N | AlarmInformation.additionalText |  |
| additionalInformation | O,N | AlarmInformation.additionalInformation |  |
| alarmId | M,N | AlarmInformation.alarmId |  |

#### 6.8.1.3 Input Parameters for notification related to security alarm

| Parameter Name | Qualifier | Matching Information | Comment | |
| --- | --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. | |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. | |
| notificationId | M,N | -- | See Table 6.8.1.2. | |
| eventTime | M,Y | AlarmInformation.alarmRaisedTime | See Table 6.8.1.2. | |
| systemDN | C,Y | -- | See Table 6.8.1.2. | |
| notificationType | M,Y | "notifyNewAlarm". |  | |
| probableCause | M,Y | AlarmInformation.probableCause |  | |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity |  | |
| rootCauseIndicator | O,N | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | | “Yes”, “No” |
| alarmType | M,Y | AlarmInformation.eventType | The notification structure of this table is applicable if this parameter indicates "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation", "Time Domain Violation". | |
| correlatedNotifications | O,N | The set of CorrelatedNotification related to this AlarmInformation. |  | |
| additionalText | O,N | AlarmInformation.additionalText |  | |
| additionalInformation | O,N | AlarmInformation.additionalInformation |  | |
| serviceUser | M,N | AlarmInformation.serviceUser | This may contain no information if the identify of the service-user (requesting the service) is not known. | |
| serviceProvider | M,N | AlarmInformation.serviceProvider | This shall always identify the service-provider receiving a service request, from serviceUser, that provokes the security alarm. | |
| securityAlarmDetector | M,N | AlarmInformation.securityAlarmDetector | This may contain no information if the detector of the security alarm is the serviceProvider. | |
| alarmId | M,N | AlarmInformation.alarmId |  | |

#### 6.8.1.4 Triggering Event

##### 6.8.1.4.1 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. |

##### 6.8.1.4.2 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, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation. |

### 6.8.2 notifyAckStateChanged (M)

#### 6.8.2.1 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.

The IRPManager and the EM can acknowledge and unacknowledge alarms as defined by 3GPP TS 32.111-1 [9]. Specifically, the AlarmIRP itself can acknowledge alarms.

The capability that IRPAgent itself acknowledges alarms is optional. The trigger, of such capability, is vendor defined. For example, it runs once a day, once every 4 hours, or always. The algorithm for determining which cleared alarm should be acknowledged is vendor specific. For example: acknowledge alarm records that have been cleared more than 24 hours or acknowledge alarm records whose highest perceived severity level has been MINOR. When acknowledged, the alarm ackState changes and the AlarmIRP shall emit the corresponding notifyAckStateChanged.

#### 6.8.2.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. |
| notificationId | M,N | -- | See Table 6.8.1.2. |
| eventTime | M,Y | AlarmInformation.ackTime | See Table 6.8.1.2. |
| systemDN | C,Y | -- | See Table 6.8.1.2. |
| notificationType | M,Y | "notifyAckStateChanged" |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceived Severity | M,Y | AlarmInformation.perceivedSeverity |  |
| alarmType | M,Y | AlarmInformation.eventType |  |
| alarmId | M,N | AlarmInformation.alarmId |  |
| ackState | M,N | AlarmInformation.ackState |  |
| ackUserId | M,N | AlarmInformation.ackUserId | If this AlarmInformation has been acknowledged by a human operator, than this parameter contains the operator identifier. If it has been acknowledged by a System (EM or NM), than this parameter contains the identifier of the System. |
| ackSystemId | O,N | AlarmInformation.ackSystemId | This parameter always contains the identifier of the System (EM or NM) where the acknowledgement request was originated. |

#### 6.8.2.3 Triggering Event

##### 6.8.2.3.1 From-state

ackedByIRPManager OR ackedByIRPAgent AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| ackedByIRPManager | Reception of a acknowledgeAlarms operation and a subsequent operation success return. |
| ackedByIRPAgent | Reception of a local (non-standard) acknowlegeAlarms equivalent operation and a subsequent operation success return. |
| alarmInformationExists | The AlarmInformation exists in AlarmList. |

##### 6.8.2.3.2 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. |

### 6.8.3 notifyClearedAlarm (M)

#### 6.8.3.1 Definition

IRPAgent notifies the subscribed IRPManager 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.

#### 6.8.3.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. |
| notificationId | M,Y | -- | See Table 6.8.1.2. |
| eventTime | M,Y | AlarmInformation.alarmClearedTime | See Table 6.8.1.2. |
| systemDN | C,Y | -- | See Table 6.8.1.2. |
| notificationType | M,Y | "notifyClearedAlarm" |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity | Its value shall indicate Cleared. |
| alarmType | M,Y | AlarmInformation.eventType |  |
| correlated Notifications | O,N | The set of CorrelatedNotification related to this AlarmInformation. | It contains references to other AlarmInformation instances whose perceivedSeverity levels are Cleared as well. In this way, perceivedSeverity level of multiple AlarmInformation instances can be Cleared by one notification. |
| clearUserId | O,N | AlarmInformation.clearUserId | It is present if the AlarmInformation is cleared by the IRPManager using clearAlarms. |
| clearSystemId | O,N | AlarmInformation.clearSystemId | It is present if clearUserId is present and if AlarmInformation.clearSystemId contains information. |
| alarmId | M,N | AlarmInformation.alarmId |  |

#### 6.8.3.3 Triggering Event

##### 6.8.3.3.1 From-state

alarmMatchedAndCleared OR clearedByIRPManager.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmMatchedAndCleared | 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  AND  The perceivedSeverity of the newly generated network alarm is cleared. |
| clearedByIRPManager | Reception of a valid clearAlarms operation that identifies the subject AlarmInformation instances. This triggering event shall occur regardless of the perceivedSeverity state of the identified AlarmInformation instances. |

##### 6.8.3.3.2 To-state

alarmInformationCleared\_1 OR alarmInformationCleared\_2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmInformationCleared\_1 | Case if From-state is alarmMatchedAndCleared:  The following attributes of the subject AlarmInformation are updated:  notificationId, perceivedSeverity (updated to Cleared), alarmClearedTime. |
| alarmInformationCleared\_2 | Case if From-state is clearedByIRPManager:  The following attributes of the subject AlarmInformation are updated:  notificationId, perceivedSeverity (updated to Cleared), alarmClearedTime, alarmClearedUserId, alarmClearedSystemId. |

### 6.8.4 notifyAlarmListRebuilt (M)

#### 6.8.4.1 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 shall invoke notifyAlarmListRebuilt notification after the AlarmList has been rebuilt.

The AlarmIRP can also invoke notifyAlarmListRebuilt notification indicating that part of the AlarmList has been rebuilt. In this case, the notification carries the class instance indicating that the AlarmList only have been rebuilt for alarms concerning this class instance and its subordinate class instances. Furthermore, this notification indicates that there is no rebuilt going on for superior class instances of this class instance.

#### 6.8.4.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | It identifies   1. the class of the instance identified by systemDN or 2. the class of MonitoredEntity. | Notification header - see [5].  If it identifies the class of the instance identified in systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.  If it identifies the class of MonitoredEntity, then some or all AlarmInformation instances in the AlarmList may have been rebuilt. See next parameter for the identification of the set of AlarmInformation that have been rebuilt. |
| objectInstance | M,Y | It identifies   1. the instance identified by systemDN or 2. an instance of MonitoredEntity. | Notification header - see [5].  If it identifies the instance identified by systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.  If it identifies an instance of MonitoredENtity, then the AlarmList only have been rebuilt for AlarmInformation of this instance and AlarmInformation of its subordinate instances. |
| notificationId | M,N | -- | See Table 6.8.1.2. |
| eventTime | M,Y | -- | Notification header - see [5]. It carries the time when the AlarmList is rebuilt. |
| systemDN | C,Y | -- | See Table 6.8.1.2. |
| notificationType | M,Y | "notifyAlarmListRebuilt". |  |
| reason | M,N | "Agent-NE communication error", "Agent restarts", "indeterminate". Other values can be added. | It carries the reason why the IRPAgent has rebuilt the AlarmList. This may carry different reasons than that carried by the immediate previous notifyPotentialFaultyAlarmList. |
| alarmListAlignmentRequirement | O(note),N | ENUM (alignmentRequired, alignmentNotRequired) | It carries an enumeration of "alignmentRequired" and "alignmentNotRequired".  IRPAgent uses alignmentRequired to indicate that IRPAgent current AL is not identical to the one that could have been built using (a) IRPAgent AL information at the time it emits the immediate previous notifyPotentialFaultyAlarmList() and (b) the notifications (carrying alarm information) emitted after the previously identified notification and before the subject notification.  Otherwise, the IRPAgent uses alignmentNotRequired.  When this parameter is absent, it implies alignmentRequired. |

NOTE: If IRPAgent supports notifyPotentialFaultyAlarmList() notification, it shall support this parameter. If IRPAgent does not support notifyPotentialFaultyAlarmList() notification, it shall not support this parameter.

#### 6.8.4.3 Triggering Event

##### 6.8.4.3.1 From-state

alarmListRebuilt\_0 OR alarmListRebuilt\_1.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmListRebuilt\_0 | IRPAgent has cold-started, initialized, re-initialized or rebooted and it has initiated procedure to rebuild its AlarmList. |
| alarmListRebuilt\_1 | IRPAgent loses confidence in part or whole of its AlarmList. IRPAgent has initiated procedure to repair its AlarmList. |

##### 6.8.4.3.2 To-state

alarmListRebuilt\_2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmListRebuilt\_2 | IRPAgent rebuilt the whole or part of AlarmList. |

## 6.9 Notification AlarmIRPNotification\_2 (O)

### 6.9.1 notifyChangedAlarm (M)

#### 6.9.1.1 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.

#### 6.9.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. |
| notificationId | M,N | -- | See Table 6.8.1.2. |
| eventTime | M,Y | AlarmInformation.alarmChangedTime | See Table 6.8.1.2. |
| systemDN | C,Y | -- | See Table 6.8.1.2. |
| notificationType | M,Y | "notifyChangedAlarm" |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity |  |
| alarmType | M,Y | AlarmInformation.eventType |  |
| alarmId | M,N | AlarmInformation.alarmId |  |

#### 6.9.1.3 Triggering Event

##### 6.9.1.3.1 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. |

##### 6.9.1.3.2 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"; |

## 6.10 Notification AlarmIRPNotification\_3 (O)

### 6.10.1 notifyComments (M)

#### 6.10.1.1 Definition

The subscribed IRPManager instances are notified regarding the addition of a Comment instance to an AlarmInformation instance in the 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.

The IRPManager and the IRPAgent can add comments to instances of AlarmInformation as described in 3GPP TS 32.111-1 [9].

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

#### 6.10.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. |
| notificationId | M,N | -- | See Table 6.8.1.2. |
| eventTime | M,Y | Comment.commentTime | Notification header - see [5]. It carries the time when the last Comment is added. |
| systemDN | C,Y | -- | Notification header - see [5]. |
| notificationType | M,Y | "notifyComments" |  |
| alarmType | M,Y | AlarmInformation.eventType |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceived Severity | M,Y | AlarmInformation.perceivedSeverity |  |
| comments | M,N | The set of Comment instances involved in a relationship with this AlarmInformation. |  |
| alarmId | M,N | AlarmInformation.alarmId |  |

#### 6.10.1.3 Triggering Events

##### 6.10.1.3.1 From-state

commentedByIRPManager OR commentedByIRPAgent AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| commentedByIRPManager | Reception of a setComment operation and a subsequent operation success return. |
| commentedByIRPAgent | Reception of a local (non-standard) setComment equivalent operation and a subsequent operation success return. |
| alarmInformationExists | The AlarmInformation is in AlarmList. |

##### 6.10.1.3.2 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 instance shall be populated:  commentTime, commentText, commentUserId and commentSystemId. |

## 6.11 Notification AlarmIRPNotification\_4 (O)

### 6.11.1 notifyPotentialFaultyAlarmList (M)

#### 6.11.1.1 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 notifyPotentialFaultyAlarmList. They then can begin to rebuild the faulty AlarmList, if found necessary. After the successful rebuilt or the discovery that rebuilt is not necessary, they shall invoke notifyAlarmListRebuilt notification.

This notification can identify a set of AlarmInformation that is potentially faulty or unreliable. This identification is done in the following way. If the MOI of an AlarmInformation is the same or is a subordinate to the MOI carried in the notification, then the AlarmInformation may be faulty or unreliable.

This notification can identify all the AlarmInformation instances of the AlarmList that are potentially faulty or unreliable. In this case, the notification shall carry a MOI identifying the IRPAgent.

The IRPManager behaviour, on reception of this notifyPotentialFaultyAlarmList notification, is not specified. The IRPManager behaviour is considered not essential for the specification of the interface itself. However, the following are recommended actions the IRPManager should take, in case it receives this notification.

1) The IRPManager should not perform any task requiring the integrity of the AlarmInformation identified as faulty or unreliable by the subject notification.

2) The IRPManager should not invoke operations that require integrity of the AlarmList such as getAlarmList., acknolwedgeAlarms operations.

#### 6.11.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | It identifies   1. the class of the instance identified by systemDN or 2. the class of MonitoredEntity. | Notification header - see [5].  If it identifies the class of the instance identified in systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.  If it identifies the class of MonitoredEntity, then some or all AlarmInformation instances in the AlarmList may not be reliable. See next parameter for the identification of the set of AlarmInformation that may not be reliable. |
| objectInstance | M,Y | It identifies   1. the instance identified by systemDN or 2. an instance of MonitoredEntity. | Notification header - see [5].  If it identifies the instance identified by systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.  If it identifies an instance of MonitoredENtity, then AlarmInformation of this instance and AlarmInformation of its subordinate instances may not be reliable. |
| notificationId | M,N | -- | Notification header - see [5]. |
| eventTime | M,Y | -- | Notification header - see [5]. It carries the time when the objectInstance has lost confidence of its AlarmList content. |
| systemDN | C,Y | -- | See Table 6.8.1.2. |
| notificationType | M,Y | "notifyPotentialFaultyAlarmList". |  |
| reason | M,N | "Agent-NE communication error", "Agent restarts", "indeterminate". Other values can be added. | It carries the reason why the IRPAgent has to rebuild its AlarmList. |

#### 6.11.1.3 Triggering Event

##### 6.11.1.3.1 From-state

faultyAlarmListDetected.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| faultyAlarmListDetected | IRPAgent detects faults in part or whole of its AlarmList. |

##### 6.11.1.3.2 To-state

faultyAlarmList

|  |  |
| --- | --- |
| Assertion Name | Definition |
| faultyAlarmList | IRPAgent initiates the AlarmList rebuild process. |

## 6.12 Notification AlarmIRPNotification\_5 (O)

### 6.12.1 notifyCorrelatedNotificationChanged (M)

#### 6.12.1.1 Definition

The set of SupportIOC CorrelatedNotification instances has been created, updated or removed. The subscribed IRPManager instances are notified of this fact if the changes satisfy the current filter constraint of their subscription.

#### 6.12.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. |
| notificationId | M,N | -- | See Table 6.8.1.2. |
| eventTime | M,Y | -- | Notification header - see [5]. It carries the time when the CorrelatedNotification is added. |
| systemDN | C,Y | -- | Notification header - see [5]. |
| notificationType | M,Y | "notifyCorrelatedNotificationChanged" |  |
| correlatedNotifications | M,N | The set of CorrelatedNotification related to this AlarmInformation. |  |
| alarmId | M,N | AlarmInformation.alarmId |  |
| rootCauseIndicator | O,N | AlarmInformation.rootCauseIndicator |  |

#### 6.12.1.3 Triggering Events

##### 6.12.1.3.1 From-state

newAlarmCorrelationInfoIsAvailable AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| newAlarmCorrelationInfoIsAvailable | New alarm correlation information is available but not yet conveyed to any IRPManager. |
| alarmInformationExists | The AlarmInformation is in AlarmList. |

##### 6.12.1.3.2 To-state

alarmCorrelatedInfoUpdated.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmCorrelatedInfoUpdated | The set of SupportIOC CorrelatedNotification instances has been created, updated or removed. |

## 6.13 Notification AlarmIRPNotification\_6 (O)

### 6.13.1 notifyChangedAlarmGeneral (M)

#### 6.13.1.1 Definition

The subscribed IRPManager instances are notified regarding changes in backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector of an AlarmInformation instance in the AlarmList. This notification is triggered by value change in one or some of these attributes. The AlarmInformation carried in the notification shall satisfy the current filter constraint of the subscription.

The notification shall contain all parameters holding a value.

There are two tables for Input Parameters. If alarmType parameter indicates "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm", the first table (see clause 6.13.1.2) shall be applicable. If alarmType parameter indicates "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation" or "Time Domain Violation", the second table (see clause 6.13.1.3) shall be applicable.

#### 6.13.1.2 Input Parameters

| Parameter Name | Qualifier | Matching Information | Comment |
| --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | Notification header - see [5]. It shall carry the MonitoredEntity class name. The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| objectInstance | M,Y | MonitoredEntity.objectInstance | Notification header - see [5]. It shall carry the DN of the MonitoredEntity. The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| notificationId | M,N | -- | Notification header - see [5]. |
| eventTime | M,Y | AlarmInformation.alarmChangedTime | Notification header - see [5]. |
| systemDN | C,Y | -- | Notification header - see [5]. |
| notificationType | M,Y | "notifyChangedAlarmGeneral". |  |
| probableCause | M,Y | AlarmInformation.probableCause |  |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity |  |
| rootCauseIndicator | O,N | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | “Yes”, “No” |
| alarmType | M,Y | AlarmInformation.eventType | The notification structure defined by this table is applicable if this parameter indicates "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm". |
| specificProblem | O,N | AlarmInformation.specificProblem |  |
| correlatedNotifications | O,N | The set of CorrelatedNotification related to this AlarmInformation. |  |
| backedUpStatus | O,N | AlarmInformation.backedUpStatus |  |
| backUpObject | O,N | MonitoredEntity.objectInstance | It carries the DN of the back up object. The object is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation. |
| trendIndication | O,N | AlarmInformation.trendIndication |  |
| thresholdInfo | O,N | AlarmInformation.thresholdInfo |  |
| stateChangeDefinition | O,N | AlarmInformation.stateChange |  |
| monitoredAttributes | O,N | AlarmInformation.monitoredAttributes |  |
| proposedRepairActions | O,N | AlarmInformaton.proposedRepairActions |  |
| additionalText | O,N | AlarmInformation.additionalText |  |
| additionalInformation | O,N | AlarmInformation.additionalInformation |  |
| alarmId | M,N | AlarmInformation.alarmId |  |
| changedAlarmAttributes | M,N | LIST OF SEQUENCE <AttributeName, OldAttributeValue> | The changed alarm attributes (name/value pairs) (with old values). |

#### 6.13.1.3 Input Parameters for notification related to security alarm

| Parameter Name | Qualifier | Matching Information | Comment | |
| --- | --- | --- | --- | --- |
| objectClass | M,Y | MonitoredEntity.objectClass | See Table 6.8.1.2. | |
| objectInstance | M,Y | MonitoredEntity.objectInstance | See Table 6.8.1.2. | |
| notificationId | M,N | -- | See Table 6.8.1.2. | |
| eventTime | M,Y | AlarmInformation.alarmChangedTime | See Table 6.8.1.2. | |
| systemDN | C,Y | -- | See Table 6.8.1.2. | |
| notificationType | M,Y | "notifyChangedAlarmGeneral". |  | |
| probableCause | M,Y | AlarmInformation.probableCause |  | |
| perceivedSeverity | M,Y | AlarmInformation.perceivedSeverity |  | |
| rootCauseIndicator | O,N | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | | “Yes”, “No” |
| alarmType | M,Y | AlarmInformation.eventType | The notification structure of this table is applicable if this parameter indicates "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation", "Time Domain Violation". | |
| correlatedNotifications | O,N | The set of CorrelatedNotification related to this AlarmInformation. |  | |
| additionalText | O,N | AlarmInformation.additionalText |  | |
| additionalInformation | O,N | AlarmInformation.additionalInformation |  | |
| serviceUser | M,N | AlarmInformation.serviceUser | This may contain no information if the identify of the service-user (requesting the service) is not known. | |
| serviceProvider | M,N | AlarmInformation.serviceProvider | This shall always identify the service-provider receiving a service request, from serviceUser, that provokes the security alarm. | |
| securityAlarmDetector | M,N | AlarmInformation.securityAlarmDetector | This may contain no information if the detector of the security alarm is the serviceProvider. | |
| alarmId | M,N | AlarmInformation.alarmId |  | |
| changedAlarmAttributes | M,N | LIST OF SEQUENCE <AttributeName, OldAttributeValue> | The changed alarm attributes (name/value pairs) (with old values). | |

#### 6.13.1.4 Triggering Event

##### 6.13.1.4.1 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. |
| alarmChanged | The backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector of the newly generated network alarm and of the matched AlarmInformation are different. |

##### 6.13.1.4.2 To-state

informationUpdate.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| informationUpdate | The AlarmInformation identified in alarmMatched in from-state has been updated according to the following rules: backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector is updated;  notificationId is updated;  alarmChangedTime is updated;  ackTime, ackUserId and ackSystemId are updated to contain no information;  ackState is updated to "unacknowledged"; |

Annex A (normative):  
Event Types

This annex lists and explains event types used by the present document.

The table below lists the event types referred to in the present document.

Notification IRP: Information Service in 3GPP TS 32.302 [5] defines a parameter called notificationType that shall be present in all notification. The present 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.

The present 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 the present 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 mapping of the IS notificationType and alarmType to CORBA event\_name or other fields are specified in the respective Solution Set.

Table A.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]). |
| Integrity Violation | An indication that information may have been illegally modified, inserted or deleted. |
| Operational Violation | An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service. |
| Physical Violation | An indication that a physical resource has been violated in a way that suggests a security attack. |
| Security Service or Mechanism Violation | An indication that a security attack has been detected by a security service or mechanism. |
| Time Domain Violation | An indication that an event has occurred at an unexpected or prohibited time. |

Annex B (normative):  
Probable Causes

This annex 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], and ITU-T Recommendation X.736 [15]. In addition, probable causes for wireless systems are listed in ETSI TS 101 251 V6.3.0 (1999-07) [18].

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 |
| Broadcast Channel Failure | Communications |
| Call Setup Failure | Communications |
| Communications Receive Failure | Communications |
| Communications Transmit Failure | Communications |
| Connection Establishment Error | Communications |
| Degraded Signal | Communications |
| Demodulation Failure | Communications |
| Far End Receiver Failure (FERF) | Communications |
| Framing Error | Communications |
| Invalid Message Received | Communications |
| Local Node Transmission Error | Communications |
| Loss Of Frame (LOF) | Communications |
| Loss Of Pointer (LOP) | Communications |
| Loss Of Signal (LOS) | Communications |
| Modulation Failure | Communications |
| Payload Type Mismatch | Communications |
| Transmission Error | Communications |
| Remote Alarm Interface | Communications |
| Remote Node Transmission Error | Communications |
| Routing Failure | Communications |
| Excessive Bit Error Rate (EBER) | Communications |
| Path Trace Mismatch | Communications |
| Unavailable | Communications |
| Signal Label Mismatch | Communications |
| Loss Of Multi Frame | Communications |
| Antenna Failure | Equipment |
| Back Plane Failure | Equipment |
| Battery Charging Failure | Equipment |
| Data Set Problem | Equipment |
| Disk Failure | Equipment |
| Equipment Identifier Duplication | Equipment |
| External IF Device Problem | Equipment |
| Frequency Hopping Failure | Equipment |
| IO Device Error | Equipment |
| Line Card Problem | Equipment |
| Loss Of Redundancy | Equipment |
| Loss Of Synchronization | Equipment |
| Multiplexer Problem | Equipment |
| NE Identifier Duplication | Equipment |
| Power Problem | Equipment |
| Power Supply Failure | Equipment |
| Processor Problem | Equipment |
| Protection Path Failure | Equipment |
| Protecting Resource Failure | Equipment |
| Protection Mechanism Failure | Equipment |
| Real Time Clock Failure | Equipment |
| Receiver Failure | Equipment |
| Replaceable Unit Missing | Equipment |
| Replaceable Unit Type Mismatch | Equipment |
| Signal Quality Evaluation Failure | Equipment |
| Synchronization Source Mismatch | Equipment |
| Terminal Problem | Equipment |
| Timing Problem | Equipment |
| Transceiver Failure | 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 |
| Cooling System Failure | Environmental |
| Engine Failure | Environmental |
| Fire Detector Failure | Environmental |
| Fuse Failure | Environmental |
| Generator Failure | Environmental |
| Low Battery Threshold | Environmental |
| Pump Failure | Environmental |
| Rectifier Failure | Environmental |
| Rectifier High Voltage | Environmental |
| Rectifier Low F Voltage | Environmental |
| Ventilation System Failure | Environmental |
| Enclosure Door Open | Environmental |
| Explosive Gas | Environmental |
| External Equipment Failure | Environmental |
| External Point Failure | 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 |
| Application Subsystem Failure | Processing Error |
| Configuration Or Customisation Error | Processing Error |
| Database Inconsistency | Processing Error |
| File Error | Processing Error |
| Storage Capacity Problem | Processing Error |
| Memory Mismatch | Processing Error |
| Corrupt Data | Processing Error |
| Loss of Real Time | Processing Error |
| Out Of CPU Cycles | Processing Error |
| Out Of Memory | Processing Error |
| Reinitialized | Processing Error |
| Software Environment Problem | Processing Error |
| Software Error | Processing Error |
| Software Download Failure | Processing Error |
| Timeout Expired | Processing Error |
| Underlaying Resources Unavailable | Processing Error |
| Version Mismatch | Processing Error |
| Bandwidth Reduced | Quality of service |
| Congestion | Quality of service |
| Excessive Error Rate | Quality of service |
| Excessive Response Time | Quality of service |
| Excessive Retransmission Rate | Quality of service |
| Reduced Logging Capability | Quality of service |
| System Resources Overload | Quality of service |

Table B.2: Probable Causes from ITU-T Recommendation X.721 [3], X.733 [2], X.736 [15]

| X.721/X.733/X.736 Probable Cause | Event type |
| --- | --- |
| Adapter Error | Equipment |
| Application Subsystem Failure | Processing error |
| Authentication Failure | Security Service or Mechanism Violation |
| Bandwidth Reduction | Quality of service |
| Breach of Confidentiality | Security Service or Mechanism Violation |
| Cable Tamper | Physical Violation |
| 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 |
| Delayed Information | Time Domain Violation |
| Denial of Service | Operational Violation |
| DTE-DCE Interface Error | Communications |
| Duplicate Information | Integrity Violation |
| 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 |
| Information Missing | Integrity Violation |
| Information Modification detected | Integrity Violation |
| Information out of Sequence | Integrity Violation |
| Input/Output Device Error | Equipment |
| Input Device Error | Equipment |
| Intrusion Detection | Physical Violation |
| Key Expired | Time Domain Violation |
| 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 |
| Non-Repudiation Failure | Security Service or Mechanism Violation |
| Out of Hours Activity | Time Domain Violation |
| Out of Memory | Processing error |
| Out of Service | Operational Violation |
| Output Device Error | Equipment |
| Performance Degraded | Quality of service |
| Power Problem | Equipment |
| Pressure Unacceptable | Environmental |
| Procedural Error | Operational Violation |
| 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 |
| Unauthorised Access Attempt | Security Service or Mechanism Violation |
| Underlying Resource Unavailable | Processing error |
| Unexpected Information | Integrity Violation |
| Unspecified Reason | Operational Violation |
| Unspecified Reason | Physical Violation |
| Unspecified Reason | Security Service or Mechanism Violation |
| Version Mismatch | Processing error |

Table B.3: Probable Causes for Wireless Systems from ETSI TS 101 251 V6.3.0 (1999-07) [18]

| Wireless Systems | 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 synchronization 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 synchronization | 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 |
| 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 initialized | 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 B.4 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 | 32.111-2 | X.721 X.733 | X.736 | M.3100 | Event Type |
| --- | --- | --- | --- | --- | --- |
| Broadcast Channel Failure | X |  |  | X | Communications |
| Call Establishment Error (X.721/X.733) Call Setup Failure (M.3100) |  | X |  | X | Communications |
| Connection Establishment Error | X |  |  | X | Communications |
| Degraded Signal |  | X |  | X | Communications |
| Framing Error |  | X |  | X | Communications |
| Invalid Message Received | X |  |  | X | Communications |
| Local Node Transmission Error |  | X |  | X | Communications |
| Loss of Frame |  | X |  | X | Communications |
| Loss of Signal |  | X |  | X | Communications |
| Remote Node Transmission Error |  | X |  | X | Communications |
| Routing Failure | X |  |  | X | Communications |
| Antenna Failure (M.3100)  Antenna Problem (32.111-2) | X |  |  | X | Equipment |
| Battery Charging Failure (M.3100)  Battery Charging Fault (32.111-2) | X |  |  | X | Equipment |
| Disk Failure (M.3100)  Disk Problem (32.111-2) | X |  |  | X | Equipment |
| Equipment Failure (32.111-2) Equipment Malfunction (X.721/X.733) | X | X |  |  | Equipment |
| Frequency Hopping Failure | X |  |  | X | Equipment |
| IO Device Error (M.3100)  Input/Output Device Error (X.721/X.733) |  | X |  | X | Equipment |
| Loss Of Redundancy (M.3100)  Lost Redundancy (32.111-2) | X |  |  | X | Equipment |
| Loss Of Synchronization | X |  |  | X | Equipment |
| Multiplexer Problem |  | X |  | X | Equipment |
| Power Problem |  | X |  | X | Equipment |
| Power Supply Failure | X |  |  | X | Equipment |
| Processor Problem |  | X |  | X | Equipment |
| Receiver Failure | X | X |  | X | Equipment |
| Signal Quality Evaluation Failure (M.3100)  Signal Quality Evaluation Fault (32.111-2) | X |  |  | X | Equipment |
| Timing Problem |  | X |  | X | Equipment |
| Transceiver Failure (M.3100)  Transceiver Problem (32.111-2) | X |  |  | X | Equipment |
| Transmitter Failure | X | X |  | X | Equipment |
| Cooling System Failure | X |  |  | X | Environmental |
| External Equipment Failure | X |  |  | X | Environmental |
| Enclosure Door Open |  | X |  | X | Environmental |
| Fan Failure (32.111-2) 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 (32.111-2) Intrusion Detection (X.736/M.3100) | X |  | X | X | Environmental (32.111-2);  Physical Violation (X.736/M.3100) |
| Low Humidity | X |  |  | X | Environmental |
| Low Temperature | X |  |  | X | Environmental |
| Pump Failure |  | X |  | X | Environmental |
| Smoke Detected (32.111-2) Smoke (M.3100) | X |  |  | X | Environmental |
| Application Subsystem Failure |  | X |  | X | Processing Error |
| Bandwidth Reduced  Bandwidth Reduction (X.721/X.733) |  | X |  | X | Quality of Service |
| Configuration or Customization Error (M.3100)  Configuration or Customizing Error (X.721/X.733) |  | X |  | X | Processing Error |
| Database Inconsistency | X |  |  | X | Processing Error |
| File Error |  | X |  | X | Processing Error |
| Storage Capacity Problem |  | X |  | X | Processing Error |
| Excessive Bit Error Rate (M.3100)  Excessive Error Rate (32.111-2)  Excessive Error Rate | X |  |  | X | Communications (M.3100)  Quality of Service (GSM 12.11/M.3100) |
| Corrupt Data |  | X |  | X | Processing Error |
| Out Of Memory |  | X |  | X | Processing Error |
| Software Error |  | X |  | X | Processing Error |
| Timeout Expired | X |  |  | X | Processing Error |
| Underlaying Resource Unavailable (M.3100)  Underlying Resource Unavailable (X.721/X.733) |  | X |  | X | Processing Error |
| Version Mismatch |  | X |  | X | Processing Error |
| Congestion |  | X |  | X | Quality of Service |
| Reduced Logging Capability | X |  |  | X | Quality of Service |
| System Resources Overload | X |  |  | X | Quality of Service |
| Excessive Response Time (M.3100)  Response Time Excessive (X.721/X.733) |  | X |  | X | Quality of Service |
| Excessive Retransmission Rate (M.3100)  Re-Transmission Rate Excessive (X.721/X,733) |  | X |  | X | Quality of Service |
| Transmission Error | X |  |  | X | Communications |

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 of a hypothetical case:

1. NotifyNewAlarm

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

1. NotifyChangedAlarm

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

1. NotifyClearedAlarm

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

EXAMPLE 2: Valid sequence of a hypothetical case (assuming that the alarm with "ai=X" is acknowledged after either (1) or (2), but before (3)):

1. NotifyNewAlarm

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

1. NotifyClearedAlarm

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

1. NotifyNewAlarm

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

1. NotifyClearedAlarm

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

EXAMPLE 3: Invalid sequence of a hypothetical case:

1. NotifyNewAlarm

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

1. NotifyChangedAlarm

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

1. 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 sequenceof a hypothetical case:

1. NotifyNewAlarm

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

1. 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):  
Examples of using correlatedNotification

This annex describes a number of examples of when the IRPAgent is indicating that several alarms are correlated.

EXAMPLE 1: Alarms X and Y are correlated, but the root cause is unknown.

Information of AlarmInformation X has been captured in a notification whose identifier is ”x”.

AlarmInformation X holds a relation to a CorrelatedNotification instance which has the following attribute values

source=”ABC”

notificationIdSet carries the identifier ”y”

X.rootCauseIndicator=”No”

Information of AlarmInformation Y has been captured in a notification whose identifier is ”y”.

Optionally, AlarmInformation Y may hold a relation to a correlatedNotification instance which has the following attribute values

source=”DEF”

notificationIdSet carries the identifier ”x”

Y.rootCauseIndicator=”No”

EXAMPLE 2: Alarms X and Y are correlated, where Alarm X is the root cause of Alarm Y.

Information of AlarmInformation X has been captured in a notification whose identifier is ”x”.

AlarmInformation X holds a relation to a correlatedNotification instance which has the following attribute values

source=”ABC”

notificationIdSet carries the identifier ”y”

X.rootCauseIndicator=”Yes”

Information of AlarmInformation Y has been captured in a notification whose identifier is ”y”.

Optionally, AlarmInformation Y may hold a relation to a correlatedNotification instance which has the following attribute values

source=”DEF”

notificationIdSet carries the identifier ”x”

Y.rootCauseIndicator=”No”

Annex E (informative):  
AcknowledgeAlarms operation scenario

The acknowledgeAlarms operation may optionally include perceivedSeverity as input parameter.

The reason for using perceivedSeverity in the acknowledgeAlarms operation is to avoid an undesirable consequence. An example sequence of events is:

1) IRPAgent AlarmList has alarmId=6 with perceivedSeverity=minor

2) IRPManager issues getAlarmList

3) IRPAgent updates alarmId=6 with perceivedSeverity=critical

4) In case IRPAgent have not issued the notifyChangedAlarm in time or in the case IRPManager ignores the notifyChangedAlarm received, for examples…

5) IRPManager issues acknowledgeAlarms of alarmId=6 with perceivedSeverity=minor

6) IRPAgent rejects acknowledgement, with reason WrongPerceivedSeverity

If the optional perceivedSeverity input parameter was not used in step 5, in step 6 the IRPAgent would have accepted the acknowledgement, with the undesirable consequences:

- IRPManager wrongly concludes that it had acknowledged alarm=6 with perceivedSeverity=minor.

- IRPAgent wrongly concludes that alarmId=6 with perceivedSeverity=critical had been acknowledged.

- Other IRPManagers will see alarmId=6 with perceivedSeverity=critical being acknowledged (and possibly taken care of) by an IRPManager.

Annex F (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| Sep 2006 | SA\_33 | SP-060527 | 0057 | -- | Add missing Notification Table in Alarm IRP IS | 6.8.0 | 6.9.0 |
| Dec 2006 | SA\_34 | SP-060722 | 0058 | -- | Add filter complexity limitation parameter | 6.9.0 | 7.0.0 |
| Mar 2007 | SA\_35 | SP-070046 | 0059 | -- | Correct the references of IRPAgent and IRPManager | 7.0.0 | 7.1.0 |
| Mar 2007 | -- | -- | -- | -- | Deleted reference to CMIP SS, discontinued from R7 onwards | 7.0.0 | 7.1.0 |
| Dec 2008 | SA\_42 | SP-080846 | 0060 | -- | Spelling and naming corrections | 7.1.0 | 8.0.0 |
| Mar 2009 | SA\_43 | SP-090207 | 0061 | -- | Include reference to SOAP Solution Set specification | 8.0.0 | 8.1.0 |
| Dec 2009 | SA\_46 | -- | -- | -- | Upgrade to Release 9 | 8.1.0 | 9.0.0 |
| Mar 2010 | SA\_47 | SP-100035 | 0062 | -- | Correct the description of the alarm list rebuilt handling capabilities. Align spec to follow recommendations of latest Repertoire and Templates. | 9.0.0 | 9.1.0 |
| Dec 2010 | SA\_50 | SP-100833 | 0063 | 2 | Add alarmChangedTime to the output parameters of getAlarmList operation. | 9.1.0 | 10.0.0 |
| Mar 2011 | SA\_51 | SP-110095 | 0064 | -- | Correct the qualifier of clearUserId in AlarmInformation | 10.0.0 | 10.1.0 |
| May 2011 | SA\_52 | SP-110285 | 0065 | 1 | Improvements to description of examples | 10.1.0 | 10.2.0 |
| May 2011 | SA\_52 | SP-110289 | 0066 | 1 | Add indication for root cause of alarm | 10.1.0 | 10.2.0 |
| May 2011 | SA\_52 | SP-110289 | 0067 | 1 | Add notification for change of alarm correlation data | 10.1.0 | 10.2.0 |
| Sep 2011 | SA\_53 | SP-110534 | 0068 | -- | Clarify usage of correlated notification | 10.2.0 | 10.3.0 |
| Sep 2011 | SA\_53 | SP-110534 | 0069 | -- | Add absent rootCauseIndicators | 10.2.0 | 10.3.0 |
| Dec 2011 | SA\_54 | SP-110707 | 0070 | 1 | Add acknowledgeAlarms operation scenario | 10.3.0 | 11.0.0 |
| Dec 2012 | SA\_58 | SP-120783 | 0072 | - | CR 32.111-2 R11 Align usage of SupportIOC with repertoire and TS 32.152 | 11.0.0 | 11.1.0 |
| 2014-10 | - | - | - | - | Update to Rel-12 version (MCC) | 11.1.0 | **12.0.0** |
| 2014-12 | SA\_66 | SP-140801 | 0073 | 1 | Alarm quality improvements, notification support for changed alarm attributes | 12.0.0 | **12.1.0** |
| 2015-03 | SA\_67 | SP-150060 | 0078 | 1 | Replacement of obsolete term “N interface" and apply alarm probable causes also to EPS" | 12.1.0 | **12.2.0** |
| 0079 | - | Remove obsolete class diagram |
| 2016-01 |  |  |  |  | Update to Rel-13(MCC) | 12.2.0 | **13.0.0** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2017-03 | SA#75 |  |  |  |  | Promotion to Release 14 without technical change | 14.0.0 |
| 2018-06 | - | - | - | - | - | Update to Rel-15 version (MCC) | 15.0.0 |
| 2019-06 | SA#84 | SP-190376 | 0081 | 1 | A | Corrections of the document references information | 15.1.0 |
| 2020-07 | - | - | - | - | - | Update to Rel-16 version (MCC) | **16.0.0** |