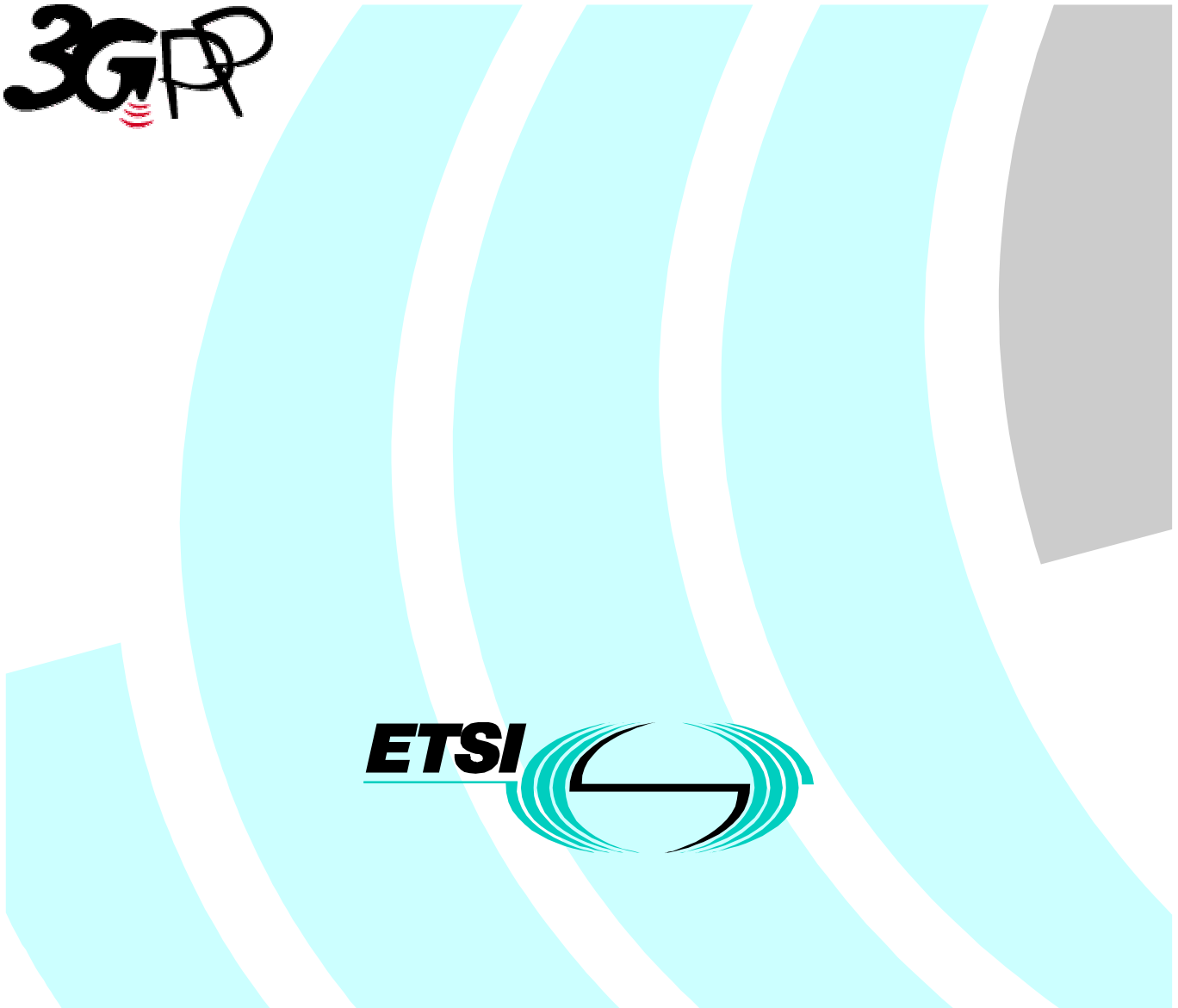
ETSI TS 132 111-2 V3.1.0 (2000-07)

Technical Specification

Universal Mobile Telecommunications System (UMTS);
Telecommunication Management; Fault Management;
Part 2: Alarm Integration Reference Point: Information Service
(3G TS 32.111-2 version 3.1.0 Release 1999)



Reference
RTS/TSGS-0532111UR2

Keywords
UMTS

ETSI

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Foreword

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Contents

Foreword

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

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

Part 1: "3G Fault Management Requirements";

Part 2: "Alarm Integration Reference Point: Information Service";

Part 3: "Alarm Integration Reference Point: CORBA Solution Set Version 1:1;

Part 4: "Alarm Integration Reference Point: CMIP Solution Set".

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

Introduction

The present document is part of a set of TSs which describe the requirements and information model necessary for the Telecommunication Management (TM) of 3G systems. The TM principles and TM architecture are specified in 3G TS 32.101 [12] and 3G TS 32.102 [13].

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

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

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

Fault Management (FM) encompasses all of the above functionalities except commissioning/decommissioning of NEs and potential operator triggered reconfiguration (these are a matter of Configuration Management (CM), cf. 3G TS 32.106 [1]).
FM also includes associated features in the Operations System (OS), such as the administration of a pending alarms 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 (3G TS 32.111 Part-2) defines the Alarm Integration Reference Point (IRP) Information Service (IS), which addresses the alarm surveillance aspects of Fault Management (FM), applied to the N Interface between EM-NM and NE-NM.

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

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

2 References

The following documents contain provisions, which through reference in this text constitute provisions of the present document. References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

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

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

[4] ITU-T Recommendation X.736: "Security Alarm Reporting Function".

[5] ITU-T Recommendation X.732: "Relationship Management Function".

[6] ITU-T Recommendation X.731: "State Management Function".

[7] ITU-T Recommendation X.730: "Object Management Function".

[8] ITU-T Recommendation X.720: "Management Information Model".

[9] ITU-T Recommendation M.3100 (07/95): "Generic network information model".

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

[11] 3G TS 32.106-2: "Notification IRP: Information Service".

[12] 3G TS 32.101: "3G Telecom Management principles and high level requirements".

[13] 3G TS 32.102: "3G Telecom Management architecture".

[14] 3G TS 32.106-8: "Name Convention for Managed Objects".

[15] 3G TS 32.111-1: "3G Fault Management".

[16] 3G TS 32.111-3: "Alarm Integration Reference Point: CORBA Solution Set Version 1:1".

[17] 3G TS 32.111-4: "Alarm Integration Reference Point: CMIP Solution Set".

3 Definitions and abbreviations

3.1 Definitions

In addition to the terms and definitions defined in 3G TS 32.111-1 [15], the following definitions apply to this document:

Acknowledge alarm: It is functionality provided to facilitate the management of alarms. The definition of the practical activity associated to the alarm acknowledgement is outside the scope of this IRP. The alarm acknowledgement process is summarised as follows:
IRPAgent, when first reports an alarm to IRPManager, will set the alarm's `Acknowledgement State` to `unacknowledged`. IRPManager, on behalf of the user (e.g. operator), can set the state to `acknowledged` by supplying (a) identifier of user acknowledging the alarm and (b) identifier of management system on which IRPManager runs. IRPAgent records the two pieces of information and the time of acknowledgement in Alarm Information of Alarm List. IRPManager representing a human operator can initiate acknowledge alarm request. IRPManager, representing an authorized management application, can initiate acknowledge alarm request as well.

Alarm List: It contains a list of Alarm Information whose severity level is not `Cleared,` or severity level is Cleared but is not yet Acknowledged. IRPAgent maintains the Alarm List.

Correlated Notifications: It contains a set of Notification identifiers. It may be present as a parameter of Notification. If present, the set of Notifications identified by Correlated Notifications and the subject Notification are related (correlated).

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

IRPManager: defined in 3G TS 32.102 [13].

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

Notification Identifier: It provides an identifier for the notification, which may be carried in the Correlated Notifications parameter (see below) of future notifications. Notification identifiers shall be chosen to be unique across all notifications of a particular managed object (representing the NE) throughout the time that correlation is significant. Notification carries this identifier in parameter called `notificationId`. The algorithm by which correlation is accomplished is outside the scope of this IRP.

IRPAgent: defined in 3G TS 32.102 [13].

3.2 Abbreviations

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

AIR	Alarm Information Reference
CCITT	The International Telegraph and Telephone Consultative Committee
CMIP	Common Management Information Protocol
EM	Element Manager
IRP	Integration Reference Point
ITU-T	International Telecommunication Union, Telecommunication Sector
M	Mandatory
MO	Managed Object
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NM	Network Manager
NMC	Network Management Centre
O	Optional

OS	Operations System
OSI	Open System Interconnection
SS	Solution Set
UML	Unified Modeling Language

4 Basic aspects

4.1 Background

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

3G TS 32.101 [12] and 32.102 [13] contain background and introductory information about IRP.

4.2 System Overview

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

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

As indicated in figure 1 and figure 2, the subject IRP need to be complemented with the Notification IRP 3G TS 32.106-2 [11] (to allow IRPManager to subscribe to notifications issued by IRPAgent) and (optionally) product-specific resource models describing the MOs maintained by IRPAgent.

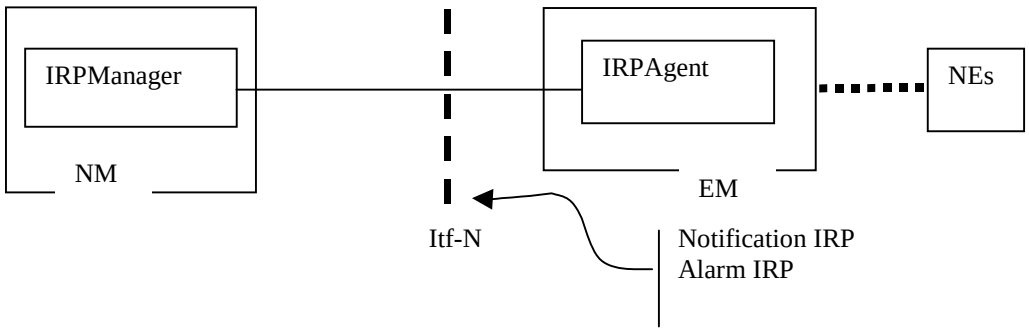

Figure 1: System Context A

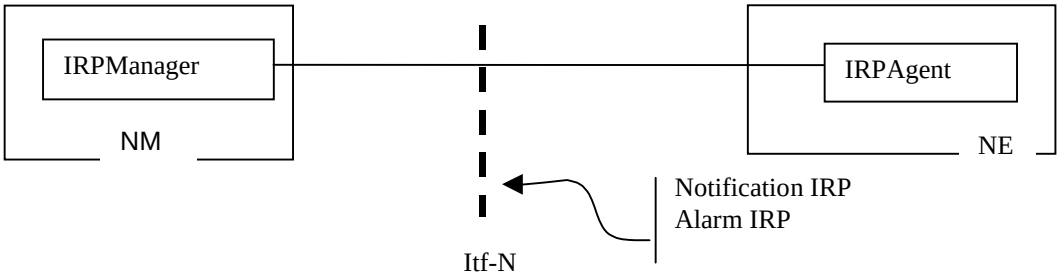

Figure 2: System Context B

5 IRP Information Service

5.1 Interfaces

Figure 3 illustrates the operations and notifications defined as interfaces implemented and used by IRPAgent and IRPManager. In this document the word "interface" is used to convey identical meaning as that defined within UML. Parameters and return status are not indicated.

Two interfaces are defined. One is called `AlarmIRPOperations`. This interface defines operations implemented by IRPAgent and used (or called by) IRPManager. The other is called `AlarmIRPNotification`. This interface defines notification implemented by IRPManager and used by IRPAgent.

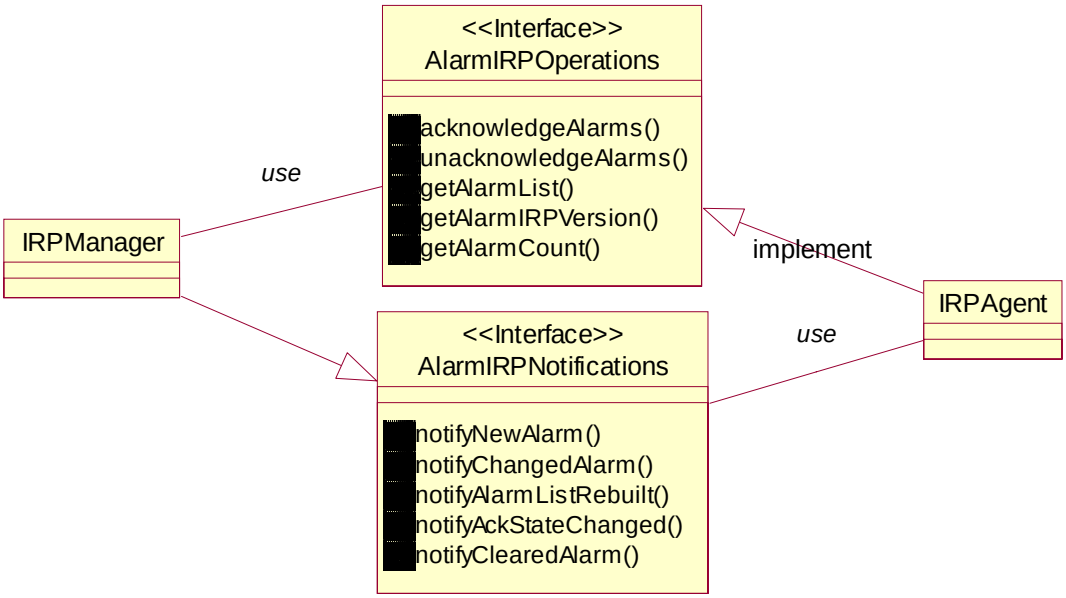

Figure 3: Operations and Notification

5.2 Operations of `AlarmIRPOperations` Interface

5.2.1 Operation `acknowledgeAlarms` (M)

IRPManager invokes this operation to acknowledge one or more alarms. IRPManager does not supply time of acknowledgement. If operation is successful, IRPAgent registers the time of operation in `ackTime` in Alarm Information in Alarm List. IRPAgent registers `ackUserId` and `ackSystemId` in Alarm Information. It sets `ackState` to "`acknowledged`" as well.

The `ackTime`, `ackUserId`, `ackSystemId` and `ackState` are collectively called Acknowledgement Information in the present document.

IRPAgent shall send notifications about Acknowledgement Information to all IRPManagers in subscriptions.

Table1: Parameters for `acknowledgeAlarms`

Name	Qualifier	Purpose
`alarm InformationReferenceList`	Input, M	It carries one or more identifiers identifying Alarm Information in Alarm List. Each identifier identifies at most one Alarm Information in Alarm List.
`AckUserId`	Input, M	It identities the user acknowledging the alarm. It can be used to identify the human operator such as "John Smith" or it can identify a group, such as "Team Six". It may contain no information implying that IRPManager does not wish this information be kept in Alarm Information in Alarm List.
`ackSystemId`	Input, O	It identifies the processing system on which the subject IRPManager runs. It may contain no information implying that IRPManager does not wish this information be kept in Alarm Information in Alarm List.
`badAlarmInformationReferenceList`	Output, M	It identifies the Alarm Information that are not present in Alarm List or that they are present, but Acknowledgement Information has not changed, in contrast to IRPManager's request. Element of this list is a pair of Alarm Information Reference and reason. This parameter shall contain at least one element in case the output `status` indicates partial failure. Otherwise, it shall contain no information.
`status`	Output, M	(a) Operation succeeded. `Acknowledgement State` of all Alarm Information (in Alarm List) identified by `alarmInformationReferenceList` are "`acknowledged`" or (b) Operation failed. No change is made to Acknowledgement Information in any Alarm Information in Alarm List. Example of one such failure is when parameter `alarmInformationReferenceList` contains no identifier or no valid identifier or (c) Operation partially failed. It indicates that at least one but not all Alarm Information (in Alarm List) identified by parameter `alarmInformationReferenceList` has changed its Acknowledgement Information according to IRPManager's request. In this case, the output parameter, called `badAlarmInformationReferenceList`, shall contain a subset of the identifiers carried in parameter `alarmInformationReferenceList`.

5.2.2 Operation `unacknowledgeAlarms` (O)

IRPManager invokes this operation to unacknowledge one or more alarms.

If operation is successful, IRPAgent shall remove all Acknowledgement Information in Alarm Information in Alarm List. It shall send notifications carrying Acknowledgement Information to all IRPManagers (including the subject IRPManager) in subscriptions. The Acknowledgement Information carried shall contain `ackUserId`, `ackTime` and `ackState`. In addition it may contain ackSystemId.

Table 2: Parameters for `unacknowledgeAlarms`

Name	Qualifier	Purpose
`alarm InformationReferenceList`	Input, M	It carries one or more identifiers identifying Alarm Information in Alarm List. Each identifier identifies at most one Alarm Information in Alarm List.
`ackUserId`	Input, M	It identities the user un-acknowledging the alarm.
`ackSystemId`	Input, O	It identifies the processing system on which the subject IRPManager runs.
`badAlarmInformationReferenceList`	Output, M	It identifies the Alarm Information that are not present in Alarm List or that they are present, but Acknowledgement Information has not changed, in contrast to IRPManager's request. Element of this list is a pair of Alarm Information Reference and reason. This parameter shall contain at least one element in case the output `status` indicates partial failure. Otherwise, it shall contain no information.
`status`	Output, M	(a) Operation succeeded. `Acknowledgement State` of the Alarm Information (in Alarm List) identified by `alarmInformationReferenceList` is "`unacknowledged`" or (b) Operation failed. No change is made to Acknowledgement Information in any Alarm Information in Alarm List. Failure examples are (a) when parameter `alarmInformationReferenceList` contains no identifier (b) it contains no valid identifier `(c)` its `ackUserId` and `ackSystemId` do not correspond to ones used in previous `acknowledgeAlarms` operation. (c) Operation partially failed. It indicates that at least one but not all Alarm Information (in Alarm List) identified by parameter `alarmInformationReferenceList` has changed its Acknowledgement Information according to IRPManager's request. In this case, the output parameter, called `badAlarmInformationReferenceList`, shall contain a subset of the identifiers carried in parameter `alarmInformationReferenceList`.

5.2.3 Operation `getAlarmList` (M)

IRPManager requests IRPAgent to provide a list of alarms in Alarm List.

Table 3: Parameters of `getAlarmList`

Name	Qualifier	Purpose
`alarmInformationList`	Output, M	It carries Alarm Information in Alarm List. Implementation of this parameter is SS dependent.
`alarmAckState`	Input, O	It has five values indicating a) all alarms b) all active alarms c) all active and acknowledged alarms d) all active and un-acknowledged alarms e) all cleared and un-acknowledged alarms. If present, IRPAgent shall use it to apply on Alarm Information in Alarm List when constructing its output parameter `alarmInformationList`. If input parameter `filter` is also present, the filter constraint carried in `filter` shall also be applied as well. If absent, IRPAgent shall return all Alarm Information in Alarm List subject to filter constraint expressed in `filter` parameter.
`filter`	Input, O	It carries a filter constraint. IRPAgent shall return Alarm Information that satisfy this filter constraint only. Filter constraint grammar is SS dependent. If parameter is absent and `subscriptionId` is present and valid, IRPAgent shall apply the current filter constraint of the subscription. If parameter is absent and `subscriptionId` is absent, IRPAgent shall return all Alarm Information in Alarm List.
`status`	Output, M	(a) Operation succeeded in that `alarmInformationList` contains the required Alarm Information or (b) Operation failed because of specified or unspecified reason.

5.2.4 Operation `getAlarmCount` (O)

IRPManager wishes to know the amount of Alarm Information kept in IRPAgent. IRPManager requests IRPAgent to provide the counts via this operation. Possible usage is for IRPManager to find out the number of Alarm Information in Alarm List before invoking `getAlarmList` operation.

Table 4: Parameters for `getAlarmCount`

Name	Qualifier	Purpose
`filter`	Input, O	It carries a filter constraint. IRPAgent shall return Alarm Information that satisfy this filter constraint only. Filter constraint grammar is SS dependent. If parameter is absent and `subscriptionId` is present and valid, IRPAgent shall apply the current filter constraint of the subscription. If parameter is absent and `subscriptionId` is absent, IRPAgent shall return all Alarm Information in Alarm List.
`alarmAckState`	Input, O	It has five values indicating a) all alarms b) all active alarms c) all active and acknowledged alarms d) all active and un-acknowledged alarms e) all cleared and un-acknowledged alarms. If present, IRPAgent shall apply it for counting. If input parameter `filter` is also present, IRPAgent shall apply the filter constraint for counting as well. If absent, IRPAgent shall count all Alarm Information, subject to filter constraint expressed in `filter` parameter.
`criticalCount, majorCount, minorCount, warningCount, indeterminateCount, clearedCount`	Output, M	They specify the number of Alarm Information whose `perceived severity` are `critical`, `major`, `minor`, `warning`, `indeterminate` and `Cleared` respectively.
`status`	Output, M	(a) Operation succeeded in that the counts returned are valid or (b) Operation failed because of specified or unspecified reason.

5.2.5 Operation `getAlarmIRPVersion` (M)

IRPManager wishes to determine the IRP versions supported by the IRPAgent. IRPAgent shall return with a list of (one or more) version numbers currently supported.

Table 5: Parameters of `getAlarmIRPVersion`

Name	Qualifier	Purpose
`versionNumberList`	Output, M	It indicates one or more SS version numbers supported by the IRPAgent.
`status`	Output, M	(a) Operation succeeded in that IRPAgent is able to provide the list of version numbers. (b) Operation failed in that the IRPAgent is not able to provide the list of supported version numbers.

5.3 Notifications of `AlarmIRPNotifications` Interface

5.3.1 General

Operations that IRPManager uses to manage subscription to receive notifications are specified in Notification IRP (3G TS 32.106-2 [11]). 3G TS 32.106-2 [11] also specifies a generic notification `notify`. 3G TS 32.106-2 [11] defines a number of parameter-attributes that are commonly carried in notifications as well.

The commonly carried parameter-attributes are collectively called `notificationHeader` in the present document. The parameter-attribute names and their qualifiers are listed in table 6.

Table 6: Notification Header

Parameter-Attributes defined in 3G TS 32.106-2 [11]	Qualifier for use in this IS
managedObjectClass	M
managedObjectInstance	M
notificationId	M
eventTime	M
systemDN	O
eventType	M
extendedEventType	M

The following clauses define specific notifications relevant for Alarm IRP by extending notify in 3G TS 32.106-2 [11].

5.3.2 Notification notifyNewAlarm (M)

IRPAgent notifies the subscribed IRPManager that a new alarm has been added into the 5.4.1 Alarm List and that the added alarm satisfies the current filter constraint of the subscription.

Table 7: Parameters of notifyNewAlarm

Name	Qualifier	Comment
notificationHeader	Input, M	See Table 6: Notification Header,
alarmInformationBody	Input, M	It contains information about the new alarm. See clause 4.4.6 Alarm Information.

5.3.3 Notification notifyChangedAlarm (O)

IRPAgent notifies subscribed IRPManager regarding changes in e.g. perceived severity level in Alarm Information in Alarm List. The Alarm Information carried in the notification shall satisfy the current filter constraint of the subscription.

Table 8: Parameters of notifyChangedAlarm

Name	Qualifier	Purpose
notificationHeader	Input, M	See Table 6: Notification Header
alarmInformationBody	Input, M	It contains information of the changed Alarm Information. See clause 4.4.6.

5.3.4 Notification notifyAckStateChanged (M)

IRPAgent notifies the subscribed IRPManager regarding changes in alarm Acknowledgement State in Alarm Information in Alarm List. The Alarm Information carried in the notification shall satisfy the current filter constraint of the subscription.

If the alarm Acknowledgement State is changed to acknowledged, the Acknowledgement Information of the Alarm Information in Alarm List shall contain ackTime and ackState indicating "acknowledged". It may contain ackUserId and ackSystemId. The Alarm Information carried in the notification shall contain identical set of parameters as well.

If the Acknowledgement State is changed to "unacknowledged", the Acknowledgement Information of the Alarm Information in the Alarm List shall be absent or shall contain no information. The Alarm Information carried in the notification shall have the Acknowledgement Information. It shall contain ackUserId, ackTime and ackState indicating unacknowledged. It may contain ackSystemId.

Table 9: Parameters of `notifyAckStateChanged`

Name	Qualifier	Purpose
`notificationHeader`	Input, M	See Table 6: Notification Header
`alarmInformationBody`	Input, M	It contains the Alarm Information whose `Acknowledgement State` has changed.

Subclause 6.1 specifies the `Alarm States` and some of these states relate to `Acknowledgement State`.

5.3.5 Notification `notifyClearedAlarm` (M)

IRPAgent notifies the subscribed IRPManager of alarm clearing if the subject Alarm Information satisfies the optional filter constraint expressed in the `subscribe` operation.

IRPAgent shall remove the Alarm Information whose `perceivedSeverity` is cleared and its `Acknowledgement State` is "`acknowledged`" from Alarm List.

Table 10: Parameters for `notifyClearedAlarm`

Name	Qualifier	Purpose
`notification Header`	Input, M	See Table 6: Notification Header
`alarmInformatio nBody`	Input, M	It contains Alarm Information whose `perceivedSeverity` is cleared. Additionally, the Alarm Information may contain `correlatedNotification` (defined in 3G TS 32.106-2 [11]) that contains references to other Alarm Information whose `perceivedSeverity` levels are cleared as well. Alternatively, it contains an Alarm Information containing a `correlatedNotification` (defined in 3G TS 32.106-2 [11]) that contains references to other Alarm Information whose `perceivedSeverity` levels are cleared.

5.3.6 Notification `notifyAlarmListRebuilt` (M)

IRPAgent maintains an Alarm List. If IRPAgent rebuilds this list for any reason, the IRPAgent shall notify IRPManager after the Alarm List is rebuilt. The conditions under which IRPAgent shall rebuild and the means by which IRPAgent shall rebuild its Alarm List are outside the scope of this IRP.

Table 11: Parameters for `notifyAlarmListRebuilt`

Name	Qualifier	Purpose
`notification Header`	Input, M	See Table 6: Notification Header
`reason`	Input, M	It provides Alarm List rebuilt reason. One valid reason is "indeterminate".

5.4 Behaviour

5.4.1 Alarm List

IRPAgent maintains an Alarm List. It contains all currently active alarms (i.e. Alarm Information whose `perceivedSeverity` is not Cleared) and alarms that are Cleared but not yet acknowledged. When an alarm is Cleared and is acknowledged, its corresponding Alarm Information in this Alarm List is removed. The removed Alarm Information shall no longer be accessible via this IRP.

IRPAgent shall create a new Alarm Information in Alarm List whenever an alarm is emitted (internally within IRPAgent) that does not match with any alarm in the Alarm List. In this case, after the creation of the new Alarm Information, IRPAgent invokes `notifyNewAlarm` operation.

IRPAgent shall not create a new Alarm Information in Alarm List when an alarm is emitted (internally within IRPAgent) that matches with an alarm in the Alarm List. In this case, IRPAgent shall invoke either (1) `notifyChangedAlarm` or (2) `notifyClearedAlarm` followed by `notifyNewAlarm` operation.

See Annex D for specification of alarm matching criterion.

In the case of a matched Alarm Information and the change is the perceived Severity value, the following additional rule shall apply.

IRPAgent shall remove all information in Acknowledgement Information of the subject Alarm Information. The `Acknowledgement State` shall be "`unacknowledged`". IRPAgent updates the `eventTime` and `perceivedSeverity` of the matched Alarm Information. IRPAgent invokes `notifyChangedAlarm` notification to all subscribed IRPManagers.

5.4.2 Network Resource Name

An alarm provides the alarm information of a specific network resource. Alarms use one parameter-attribute, Managed Object Instance (MOI), to identify the network resource. The semantics of MOI is defined in ITU-T Recommendation X.720 [8]. The MOI shall be unique within a certain context, such as a transmission network or a switching network. This IRP does not specify the context.

The encoding of MOI parameter-attribute value is SS dependent and is specified in ITU-T Recommendation X.720 [8] and 3G TS 32.106-8 [14].

5.4.3 Alarm Information Identification

Since IRPManager can acknowledge and unacknowledge Alarm Informations currently kept in Alarm List of IRPAgent, there is a need to establish a convention so IRPManager and IRPAgent can unambiguously identify Alarm Informations in Alarm List.

Since IRPAgent can generate notifications about the state change (e.g. `perceivedSeverity` level changes or `Acknowledgement State` changes) of an Alarm Information in Alarm List, there is a need to establish a convention so IRPManager and IRPAgent can unambiguously identify the Alarm Information whose state has changed.

The convention, to identify Alarm Information, is the subject of this clause.

5.4.3.1 Use of `alarmInformationReference`

An `alarmInformationReference` (AIR) unambiguously identifies one Alarm Information in IRPAgent's Alarm List. One IRPAgent has one Alarm List. The IRPAgent assigns AIR for the Alarm Informations in its own Alarm List.

IRPAgent includes AIR in all notifications it emits.

IRPManager shall include AIR(s) in acknowledgeAlarms and unacknowledgeAlarms.

The mapping of AIR into its equivalents in respectively SS are done in Annex D.

5.4.4 Alarm loss detection and recovery

This IRP does not specify methods for IRPManager to detect alarm loss. The use of `alarmId` (see clause 4.4.3.1) to detect alarm loss is an arrangement made between IRPAgent and IRPManager. This arrangement is outside the scope of this IRP. For example, IRPAgent may use integer sequence (e.g. 1, 2, 3, 4, 5…) as `alarmIds` for its alarms. Based on this knowledge, IRPManager can detect alarm loss. This kind of arrangement may not be possible for all SS.

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

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

5.4.5 Alarm List loss

IRPAgent can lose confidence in the integrity of its Alarm List. Under this condition, IRPAgent shall invoke `notifyAlarmListRebuilt` notification after it has successfully rebuilt the Alarm List.

5.4.6 Alarm Information

This clause specifies the information contained in Alarm Information.

Alarm Information(s) are stored in Alarm List. They are carried in `notifyNewAlarm, notifyChangedAlarm, notifyAckStateChanged, notifyClearedAlarm.` They are also carried in the response to `getAlarmList` operation.

When it is carried in `notifyChangedAlarm` notification, it indicates that one or more parameter-attribute values of the Alarm Information have changed since the most recent `notifyNewAlarm` or `notifyChangedAlarm` notification on the subject alarm. The following table identifies, using the symbol [Y] under "Qualifier" column, those parameters-attributes whose value changes would trigger IRPAgent to invoke `notifyChangedAlarm` or `notifyAckStateChanged` notification.

When the alarm is carried in `notifyChangedAlarm` or `notifyAckStateChanged` notification, the following rule shall apply:

- At least the value of one parameter-attribute marked with [Y] shall be different than that carried in the most recent `notifyNewAlarm` or `notifyChangedAlarm` of the subject alarm.

Alarm Information, carried in notifications, always contain the AIR. In `notifyNewAlarm`, the AIR is used to identify the active Alarm Information carried in the notification. In `notifyChangedAlarm` and `notifyClearedAlarm`, the AIR is used to identify the active Alarm Information whose state has changed. In `notifyAckStateChangedAlarm`, the AIR is used to identify the Alarm Information (active or inactive) in the Alarm List whose acknowledgement state has changed.

Alarm Information contains the `notificationHeader` and `alarmInformationBody`. Table 6 defines parameter-attributes of `notificationHeader`. Table 13 defines the parameter-attributes of `alarmInformationBody`.

Letter M and O stands for Mandatory and Optional respectively. Letter Y identifies the parameter-attribute whose value changes would trigger IRPAgent to invoke `notifyChangedAlarm or notifyAckStateChanged.`

Table 13: Parameter-Attributes of `alarmInformationBody`

Name	Qualifier	Comment
`probable Cause`	M	It qualifies alarm and provides further information than `eventType`. See Annex B for a complete listing. This list is extensive. It is recommended that IRPAgent should use the list as is and not to extend it. It is noted that IRPAgent can privately (outside the scope of this IRP) define values for `specificProblem` that provides semantics not conveyed by `probableCause`. A special probable cause value (SS specific, e.g. –1) indicates that this alternative is valid. This parameter-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 8.1.2.1.
`perceived Severity`	M, Y	It indicates the relative level of urgency for operator attention. . Legal values are `Critical, Major, Minor, Warning, Indeterminate` and `Cleared,` according to ITU-T Recommendation X.733 [2]. This IRP does not recommend the use of indeterminate.
`specific Problem`	O	It provides further qualification on the alarm than `probableCause`. This parameter-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.
`correlated Notifications`	O	It identifies a set of notifications to which this notification is considered to be correlated. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.9.
`backedUpStatus`	O, Y	It indicates if an object has a back up. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.4.
`backUpObject`	O, Y	It carries the DN of the back up object. It shall be absent if backUpStatus is absent or its value indicates false. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.5.
`trend Indication`	O, Y	It indicates if some observed condition is getting better, worse, or not changing. Legal values are "less severe", "no change" and "more severe". See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.6.
`threshold Info`	O, Y	It indicates if the threshold crossed was in the up or down direction. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.7.
`stateChange Definition`	O, Y	It indicates MO attribute value changes. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.10.
`monitored Attributes`	O, Y	It indicates MO attributes whose value changes are being monitored. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.11.
`proposed Repair Actions`	O, Y	It indicates proposed repair actions. See definition in ITU-T Recommendation X.733 [2] clause 8.1.2.12.
`additional Text`	O,	It provides 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 MOC representing the NE in the Basic CM IRP Information Model. It can contain further information on the alarm.
`additional Information`	(see next column)	It carries additional information related to the subject Alarm Information. It may contain the following parameter-attributes. `AlarmId` [Y]: It identifies at most one Alarm Information in the Alarm List. See clause 5.4.3.1. Use of this parameter-attribute is SS dependent. `ackTime` [Y]: It identifies the time of last operation `acknowledgeAlarms` or `unacknowledgeAlarms`. It is mandatory for `notifyAckStateChanged`, it is optional for other notifications. `ackUserId` [Y]: It identifies the last user who has change the `Acknowledgement State` via operation `acknowledgeAlarms` or `unacknowledgeAlarms`. It is mandatory for `notifyAckStateChanged`, it is optional for other notifications. `ackSystemId` [Y]: It identifies the system in which IRPManager, that invokes the `acknowledgeAlarms` or `unacknowledgeAlarms` operation, runs. It is optional for all notifications. `ackState` [Y]: It identifies the `Acknowledgement State` of the alarm. Its valid values are "`acknowledged`" and "`unacknowledged`". It is mandatory for `notifyAckStateChanged`, it is optional for other notifications.

6 Dynamic Model

6.1 Alarm states

Alarms have states. Figure 4 illustrates the alarm states.

The triggers "MO emits…" are internal within IRPAgent and are not observable via the Alarm IRP. Other triggers, e.g. "`acknowledgeAlarms`", are observable via the Alarm IRP.

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 alarm shall not be accessible via the IRP and is removed from the Alarm List.

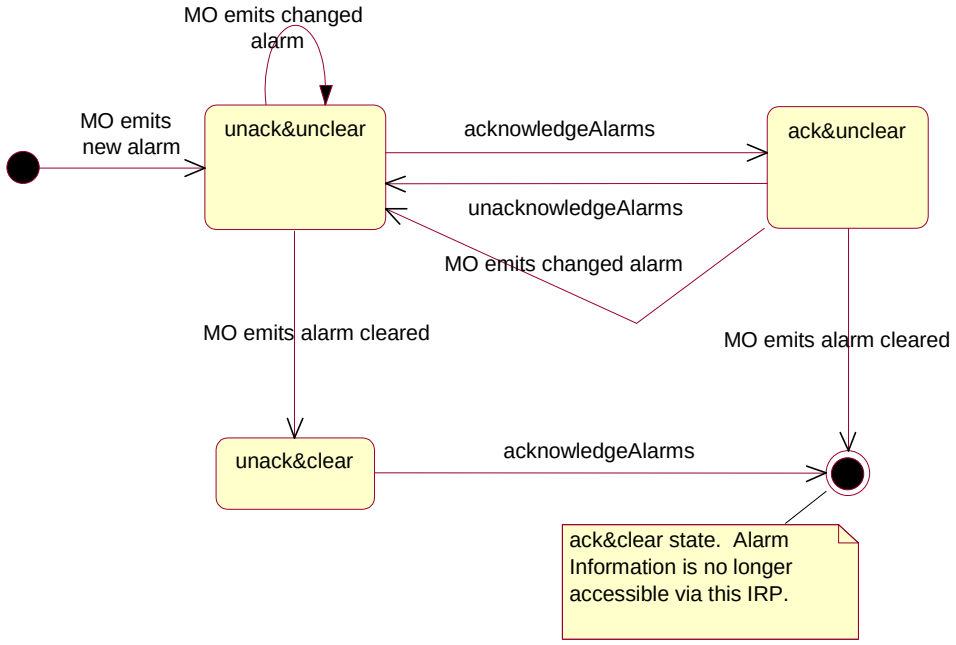

Figure 4: Alarm States

Annex A (normative): Event Types and Extended Event Types

This appendix lists and explains event types and extended event types used by Alarm IRP.

Event type is carried by a parameter called `eventType` defined in 3G TS 32.106-2 [11].

Extended event types is acrried by a parameter called extendedEventType 3G TS 32.106-2 [11].

Encoding of `eventType and extendedEventType` is SS dependent. For example, the value of `eventType` can be encoded as Object Identifier in CMIP SS and as numeric string in CORBA SS.

Table 14 and table 15 may be extended in the future.

TableA.1: Event Types

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

Table A.2: Extended Event Types

Extended Event Types	Explanation
New Alarm	A notification of this type indicates that a new alarm has occurred.
Changed Alarm	A notification of this type indicates that one or more attributes, excepting those related to acknowledgement state, of an active alarm have changed.
Acknowledgement State Changed	A notification of this type indicates that the acnowledgement state of an alarm has changed.
Cleared Alarm	A notification of this type indicates that an alarm has been cleared and is no longer active.
Alarm List Rebuilt	A notification of this type indicates that the Alarm List has been succesfully rebuilt.

Annex B (normative): Probable Causes

This appendix lists probable causes and their corresponding event types.

Sources of these probable causes are ITU-T Recommendation M.3100 [9], ITU-T Recommendation X.721 [3], ITU-T Recommendation X.733 [2], ITU-T Recommendation X.736 [4] and GSM 12.11 [10].

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

Table B.1: Probable Causes from ITU-T Recommendation M.3100 [9]

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

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

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

X.733 Probable Cause	Event type
Adapter Error	Equipment
Application Subsystem Failure	Processing error
Bandwidth Reduction	Quality of service
Call Establishment Error	Communications
Communication Protocol Error	Communications
Communication Subsystem Failure	Communications
Configuration or Customizing Error	Processing error
Congestion	Quality of service
Corrupt Data	Processing error
CPU Cycles Limit Exceeded	Processing error
Data Set or Modem Error	Equipment
Degraded Signal	Communications
DTE-DCE Interface Error	Communications
Enclosure Door Open	Environmental
Equipment Malfunction	Equipment
Excessive Vibration	Environmental
File Error	Processing error
Fire Detected	Environmental
Flood Detected	Environmental
Framing Error	Communications
Heating or Ventilation or Cooling System Problem	Environmental
Humidity Unacceptable	Environmental
Input/Output Device Error	Equipment
Input Device Error	Equipment
LAN Error	Communications
Leak Detection	Environmental
Local Node Transmission Error	Communications
Loss of Frame	Communications
Loss of Signal	Communications
Material Supply Exhausted	Environmental
Multiplexer Problem	Equipment
Out of Memory	Processing error
Output Device Error	Equipment
Performance Degraded	Quality of service
Power Problem	Equipment
Pressure Unacceptable	Environmental
Processor Problem	Equipment
Pump Failure	Environmental
Queue Size Exceeded	Quality of service
Receive Failure	Equipment
Receiver Failure	Equipment
Remote Node Transmission Error	Communications
Resource at or Nearing Capacity	Quality of service
Response Time Excessive	Quality of service
Re-transmission Rate Excessive	Quality of service
Software Error	Processing error
Software Program Abnormally Terminated	Processing error
Software Program Error	Processing error
Storage Capacity Problem	Processing error
Temperature Unacceptable	Environmental
Threshold Crossed	Quality of service
Timing Problem	Equipment
Toxic Leak Detected	Environmental
Transmit Failure	Equipment
Transmitter Failure	Equipment
Underlying Resource Unavailable	Processing error
Version Mismatch	Processing error

Table B.3: Probable Causes from GSM 12.11 [10]

GSM 12.11 Probable Cause	Event Type
A-bis to BTS interface failure	Equipment
A-bis to TRX interface failure	Equipment
Antenna problem	Equipment
Battery breakdown	Equipment
Battery charging fault	Equipment
Clock synchronisation problem	Equipment
Combiner problem	Equipment
Disk problem	Equipment
Equipment failure	Equipment
Excessive receiver temperature	Equipment
Excessive transmitter output power	Equipment
Excessive transmitter temperature	Equipment
Frequency hopping degraded	Equipment
Frequency hopping failure	Equipment
Frequency redefinition failed	Equipment
Line interface failure	Equipment
Link failure	Equipment
Loss of synchronisation	Equipment
Lost redundancy	Equipment
Mains breakdown with battery back-up	Equipment
Mains breakdown without battery back-up	Equipment
Power supply failure	Equipment
Receiver antenna fault	Equipment
Receiver Failure	Equipment
Receiver multicoupler failure	Equipment
Reduced transmitter output power	Equipment
Signal quality evaluation fault	Equipment
Timeslot hardware failure	Equipment
Transceiver problem	Equipment
Transcoder problem	Equipment
Transcoder or rate adapter problem	Equipment
Transmitter antenna failure	Equipment
Transmitter antenna not adjusted	Equipment
Transmitter failure	Equipment
Transmitter low voltage or current	Equipment
Transmitter off frequency	Equipment
Database inconsistency	Processing error
File system call unsuccessful	Processing error
Input parameter out of range	Processing error
Invalid parameter	Processing error
Invalid pointer	Processing error
Message not expected	Processing error
Message not initialised	Processing error
Message out of sequence	Processing error
System call unsuccessful	Processing error
Timeout expired	Processing error
Variable out of range	Processing error
Watch dog timer expired	Processing error
Cooling system failure	Environmental
External equipment failure	Environmental
External power supply failure	Environmental
External transmission device failure	Environmental
Fan failure	Environmental
High humidity	Environmental
High temperature	Environmental
Intrusion detected	Environmental
Low humidity	Environmental
Low temperature	Environmental
Smoke detected	Environmental
Excessive Error Rate	Quality of service
Reduced alarm reporting	Quality of service
Reduced event reporting	Quality of service

GSM 12.11 Probable Cause	Event Type
Reduced logging capability	Quality of service
System resources overload	Quality of service
Broadcast channel failure	Communications
Connection establishment error	Communications
Invalid message received	Communications
Invalid MSU received	Communications
LAPD link protocol failure	Communications
Local alarm indication	Communications
Remote alarm indication	Communications
Routing failure	Communications
SS7 protocol failure	Communications
Transmission error	Communications

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

Table B.4: Duplicated Probable Causes

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

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

This appendix 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, say critical to minor and then to Cleared.

In the 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`.

Valid sequence 1 to support the hypothetical case:

(1) NotifyNewAlarm

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

(2) NotifyChangedAlarm

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

(3) NotifyClearedAlarm

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

Valid sequence 2 to support the hypothetical case:

(1) NotifyNewAlarm

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

(2) NotifyClearedAlarm

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

(3) NotifyNewAlarm

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

(4) NotifyClearedAlarm

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

Invalid sequence 1 to support the hypothetical case:

(1) NotifyNewAlarm

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

(2) NotifyChangedAlarm

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

(3) NotifyClearedAlarm

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

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

Invalid sequence 2 to support the hypothetical case:

(1) NotifyNewAlarm

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

(2) NotifyNewAlarm

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

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

Annex D (normative): Mapping of Alarm Information Reference to its Solution Set Equivalents

This appendix specifies the mapping of AIR into its SS equivalents. It also specifies the conditions under which these attributes shall be used in the mapping process.

Currently, there are two methods to map AIR into SS equivalents. One method is the use of `managedObjectInstance` and `notificationId` whose semantics are defined by ITU-T. The other method is the use of `alarmId` whose semantics is identical to AIR.

Table 21 specifies how identification of Alarm Information is achieved, with and without the use of `alarmId`.

Table D.1: AIR Mapping Process

	`AlarmId` is used	**`AlarmId` is not used**
`AcknowledgeAlarm`, `unacknowledgeAlarm`	IRPManager places value of `alarmId` of the received `notifyNewAlarm` or related `notifyChangedAlarm` or related `notifyClearedAlarm` (they shall have the same value) in AIRs of `alarmInformationReferenceList` of this operation. IRPManager can place multiple values.	IRPManager places values of `managedObjectInstance` and `notificationId` of the received `notifyNewAlarm` notification in `AIRs of alarmInformationReferenceList` of this operation. IRPManager can place multiple pairs of values.
`notifyNewAlarm`	IRPAgent assignes a new `alarmId` for this notification. AIR is mapped to this `alarmId`. IRPAgent creates a new Alarm Information. This new Alarm Information is classified as active.	IRPAgent assignes a new `notificationId` to this notification. AIR is mapped to the `managedObjectInstance` and the `notificationId` of this notification. IRPAgent creates a new Alarm Information. This new Alarm Information is classified as active.
`notifyChangedAlarm`	IRPAgent uses the same `alarmId` of the related `notifyNewAlarm` for the `alarmId` of this notification. AIR is mapped to this `alarmId`. IRPAgent shall not create a new Alarm Information.	IRPAgent assignes a new `notificationId` to this notification. AIR is mapped to the matching-criteria-attributes (defined below) of this notification. The value of this set of attributes shall be identical to that of one active Alarm Information in the Alarm List. IRPAgent shall not create a new Alarm Information.
`notifyClearedAlarm`	IRPAgent uses the same `alarmId` of the related `notifyNewAlarm` for the `alarmId` of this notification. AIR is mapped to this `alarmId`. The IRPAgent shall not create a new Alarm Information. IRPAgent cannot indicate alarm clearing of more than one Alarm Information.	IRPAgent assignes a new notificationId to this notification. IRPAgent shall not create a new Alarm Information AIR is mapped to the matching-criteria-attributes of this notification. The value of this set of attributes shall be identical to that of one active Alarm Information in the Alarm List. Additionally (in the same notification), IRPAgent may use `correlatedNotifications` to carry AIRs of other active Alarm Informations whose `perceivedSeverity` is now set to Cleared as well. (in accordance to ITU-T Recommendation X.733 [2]) or

	AlarmId is used	AlarmId is not used
		IRPAgent shall use correlatedNotifications exclusively to carry AIRs of active Alarm Informations whose perceivedSeverity is now set to Cleared. (in accordance with ITU-T Recommendation Q821 [1]).
notifyAckStateChanged	IRPAgent uses the same alarmId of the related notifyNewAlarm for the alarmId of this notification. AIR is mapped to this alarmId. The IRPAgent shall not create a new Alarm Information. IRPAgent cannot indicate Acknowledgement State change of more than one Alarm Information.	IRPAgent assignes a new notificationId to this notification. IRPAgent shall not create a new Alarm Information. AIR is mapped to the matching-criteria-attributes of this notification. The value of this set of attributes shall be identical to that of the active Alarm Information in the Alarm List. Additionally (in the same notification), IRPAgent may use correlatedNotifications to carry AIRs of other Alarm Informations whose Acknowledgement State has changed as well. (in accordance to ITU-T Recommendation X.733 [2]) or IRPAgent shall use correlatedNotifications exclusively to carry AIRs of Alarm Informations whose Acknowledgement State has changed. (in accordance to ITU-T Recommendation Q821 [1]).

D.1 Matching-Criteria-Attributes

This clause identifies attributes that are defined in ITU-T Recommendation X.733 [2] as the matching-criteria-attributes. The attributes are:

- managedObjectInstance
- eventType
- probableCause
- specificProblem, if present

Annex E (informative): Change history

Change history					
TSG SA#	**Version**	**CR**	**Tdoc SA**	**New Version**	**Subject/Comment**
S_07	2.0.0	-	SP-000012	3.0.0	Approved at TSG SA #7 and placed under Change Control
Mar 2000	3.0.0			3.0.1	cosmetic
S_08	3.0.1	004	SP-000250	3.1.0	Split of TS - Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)

History

Document history		
V3.0.1	March 2000	Publication as TS 132 111
V3.1.0	July 2000	Publication