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**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
LTE;
Telecommunication management;
Advanced Alarm Management (AAM)
Integration Reference Point (IRP): Information Service (IS)
(3GPP TS 32.122 version 15.0.0 Release 15)**

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Contents

Foreword

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

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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:

32.121: Advanced Alarm Management (AAM) Integration Reference Point (IRP): Requirements;

32.122: Advanced Alarm Management (AAM) Integration Reference Point (IRP): Information Service (IS);

32.126: Advanced Alarm Management (AAM) Integration Reference Point (IRP); Solution Set (SS) definitions.

The Itf-N interface is built up by a number of IRPs and a related Name Convention, which realize the functional capabilities over this interface. The basic structure of the IRPs is defined in 3GPP TS 32.150 [1].

A single network fault may generate a large number of alarms over space and time. In a large and complex network, simultaneous network faults may occur, causing the network operator to be flooded with high volume of alarms. The high volume of alarms, typically the one received by an `IRPManager` via the `getAlarmList` or alarm notifications of Alarm IRP specification, greatly inhibits the operator ability to quickly identify and locate the responsible network faults. AAM IRP is intended to provide methods to improve this situation.

1 Scope

The purpose of Advanced Alarm Management (AAM) IRP is to define an interface through which an `IRPManager` can categorize alarm notifications.

The present document is the Information Service of AAM. It defines, for the purpose of categorizing alarm notifications, the information observable and controlled by management system's client and it also specifies the semantics of the interactions used to carry this information.

2 References

The following documents contain provisions that, 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] 3GPP TS 32.102: "Telecommunication management; Architecture".

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

[4] 3GPP TS 32.121: "Telecommunication management; Advanced Alarm Management Reference Point (IRP): Requirements".

[5] void.

[6] 3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".

[7] 3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management; Information Service (IS)".

[8] 3GPP TS 32.602: "Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP): Information Service (SS)".

[9] 3GPP TS 32.662: "Telecommunication management; Configuration Management (CM); Kernel CM; Information service (IS)".

3 Definitions and abbreviations

3.1 Definitions

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

IRP: See 3GPP TS 32.150 [1].

`IRPAgent`: See 3GPP TS 32.150 [1].

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

Alike Alarm: Two alarms are considered alike, if the corresponding alarm notifications are issued by the same object instance with the same `alarmType`, same `perceivedSeverity`, same `probableCause` and same `specificProblem` (if present).

Lower Edge of Time Window: The point in time which determines the begin of a time span.

Upper Edge of Time Window: The point in time which determines the end of a time span.

3.2 Abbreviations

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

AAM	Advanced Alarm Management
AAMRule	Advanced Alarm Management Rule
CM	Configuration Management
EM	Element Manager
IOC	Information Object Class
IRP	Integration Reference Point
IS	Information Service
Itf-N	Interface N
MIB	Management Information Base
NE	Network Element

4 System overview

4.1 System context

The general definition of the System Context for the present IRP is found in 3GPP TS 32.150 [1], clause 4.7.

In addition, the set of related IRP(s) relevant to the present IRP is shown in figures 4.1-1 and 4.1-2.

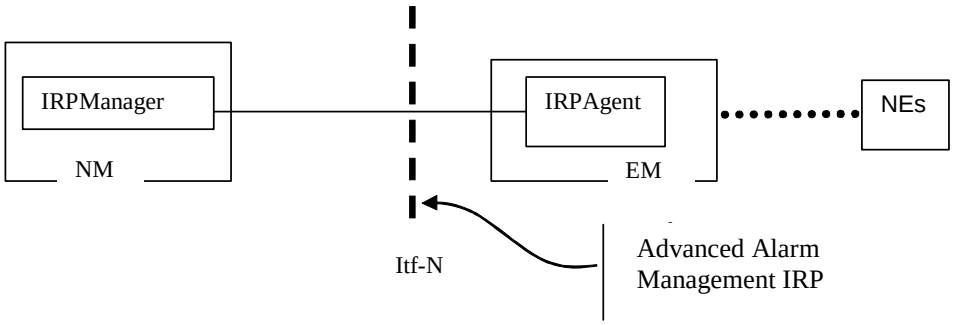


Figure 4.1-1: System Context A

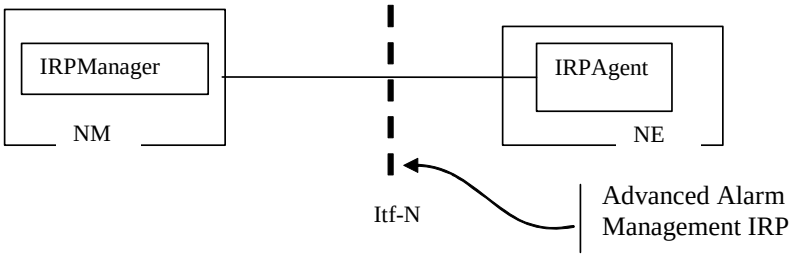


Figure 4.1-2: System Context B

5 Information Object Classes

5.1 Imported information entities and local labels

Label reference	Local label
3GPP TS 32.622 [6], information object class, `Top`	`Top`
3GPP TS 32.312 [7], information object class, `managedGenericIRP`	`managedGenericIRP`
3GPP TS 32.622 [6], information object class, `IRPAgent`	`IRPAgent`

5.2 Class diagram

5.2.1 Attributes and relationships

This clause depicts the set of IOCs that encapsulate information within the AAM IRP. The intent is to identify the information required for the AAM IRP implementation of its operations and notification emission.
This clause provides the overview of all Information Object Classes in UML.
Subsequent clauses provide more detailed specification of various aspects of these Information Object Classes.

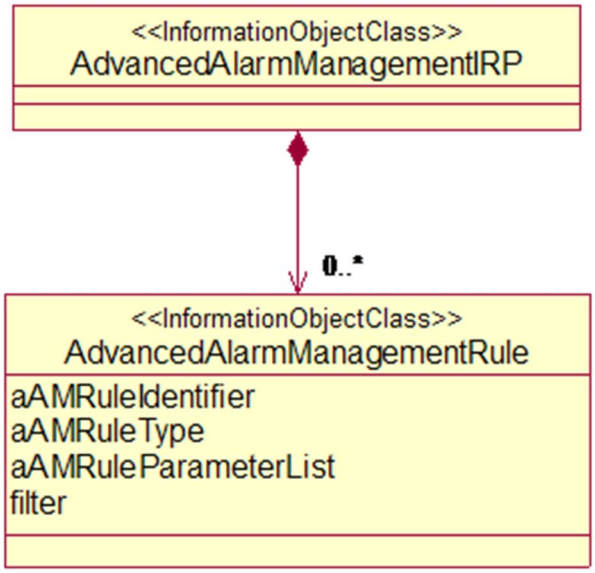


Figure 5.2.1-1: Class Diagram

5.2.2 Inheritance

This clause depicts the inheritance relationships that exist between Information Object Classes.

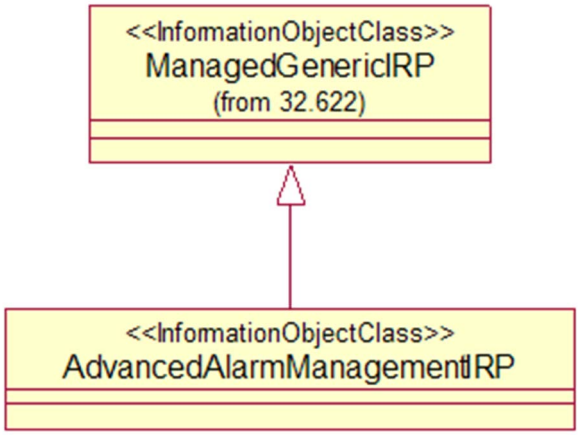


Figure 5.2.2-1: Inheritance Diagram

5.3 Information Object Class definitions

5.3.1 advancedAlarmManagementRule

5.3.1.1 Definition

5.3.1.1.1 General Definition

This information object represents an AAM Rule object instance.

An `AdvancedAlarmManagementRule` is fully identified by its distinguished name.

It inherits from IOC top.

An AAM Rule is a way for the `IRPManager` to define which alarms / alarm clearings deliver significant or insignificant information (significant seen with the eyes of the `IRPManager`) and to tell the `IRPAgent` not to send the insignificant alarms / alarm clearings.

AAMRules will not screen out all insignificant alarms/alarm clearings, but contribute to enable the network operator to reduce the number of reported alarms to a reasonable and manageable level.

The choice of rule/s may depend on the type of alarm, the environment, the time of day and many more.

To avoid screening of alarms which might be important for the network operator, the user of AAM rules should apply AAMrules with careful consideration and appropriate setting of parameters.

An AAM Rule instance is fully identified by its DNdistinguished name. A Rule instance carries, among other things, the identification of the Rule type called `AdvancedAlarmManagementRuleType`. Of these there exist the following:

- ThresholdRule
- TransientRule
- ToggleRule
- VendorSpecificRule

See Annex A for the description of the above Rules.

5.3.1.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
`advancedAlarmManagementRuleIdentifier`	M	M	-
`advancedAlarmManagementRuleType`	M	M	-
`advancedAlarmManagementRuleParameterList`	M	M	-
`filter`	M	M	-

5.3.2 advancedAlarmManagementIRP

5.3.2.1 Definition

This information object represents an AAM IRP. It inherits from IOC managedGenericIRP.

5.4 Information relationships definition

5.4.1 relation- AdvancedAlarmManagementIRP-AdvancedAlarm ManagementRule (M)

5.4.1.1 Definition

This relationship defines the relationship between an AdvancedAlarmManagementIRP and an AdvancedAlarmManagementRule instance.

5.4.1.2 Roles

Name	Definition
theAdvancedAlarmManagementRule	This role represents an AAM Rule. It can be played by instances of IOC advancedAlarmingRule
theAdvancedAlarmManagementIRP	This role represents the AAM IRP which an IRPManager uses. It is played by instances of IOC advancedAlarm Management IRP

5.4.1.3 Constraints

None

5.5 Information attributes definition

This clause defines the semantics of the Attributes used in Information Object Classes.

5.5.1 Definitions and legal values

Attribute Name	Definition	Legal Values
advancedAlarmManagementRuleIdentifier	This attribute identifies uniquely an AAM Rule base object instance	String
advancedAlarmManagementRuleType	This attribute indicates the type of AAM Rule this instance represents.	String
advancedAlarmManagementRuleParameterList	This attribute identifies parameters and values of this AAM Rule	N/A

6 Interface Definition

6.1 Class diagram representing interfaces

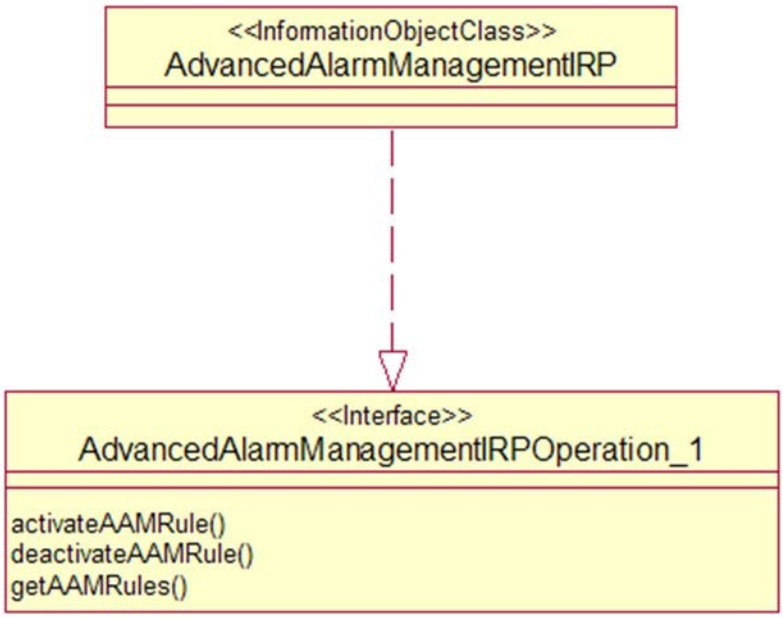


Figure 6.1-1: Class Diagram for AdvancedAlarmManagementIRPOperation_1 Interface

6.2 AAMIRPOperation_1 Interface (M)

6.2.1 Scope

This interface defines methods for the IRPManager to request the IRPAgent for alarm notifications of significant information (significant from the IRPManager's perspective).

The definition of insignificance is determined by the IRPManager. The choice of AAM Rule/s may depend on the type of alarm, the environment, the time of day and many more.

An implementation can claim compliance to this IRP if it supports at least one of the AAMRules, i.e. one of the operations defined in clause 6.2.2 up to and including clause 6.2.5, and the mandatory operations defined in this interface.

6.2.2 Operation activateAAMRule (M)

6.2.2.1 Definition

This operation allows the IRPManager to request the IRPAgent to activate an AAM rule.

6.2.2.2 Input parameters

6.2.2.2.1 Generic Input parameters

Parameter Name	Qualifier	Information type	Comment
aAMRuleType	M	N/A	This corresponds to attribute advancedAlarmManagementRuleType of advancedAlarmManagementRule (see 5.3.1.2) Values: ThresholdRule, TransientRule, ToggleRule, VendorSpecificRule
aAMRuleParameterList	M	N/A	This corresponds to attribute advancedAlarmManagementRuleParameterList of advancedAlarmManagementRule (see 5.3.1.2) Content depends on value of advancedAlarmManagementRuleType
filter	M	N/A	This corresponds to attribute filter of advancedAlarmManagementRule (see 5.3.1.2) Carries a filter constraint. It can e.g. comprise objectClass, objectInstance, alarmType, probableCause, perceivedSeverity, specificProblem.

6.2.2.2.2 Content of Input parameter aAMRuleParameterList depending on value of aAMRuleType

6.2.2.2.2.1 aAMRuleType = ThresholdRule

Parameter Name	Qualifier	Information type	Comment
alarmOccurenceThreshold	M	N/A	value >0
slidingTimeWindow	M	N/A	Unit: minutes

6.2.2.2.2.2 aAMRuleType = TransientRule

Parameter Name	Qualifier	Information type	Comment
timeSpan	M	N/A	Unit: minutes

6.2.2.2.2.3 aAMRuleType = ToggleRule

Parameter Name	Qualifier	Information type	Comment
alarmOccurenceThreshold	M	N/A	value>0
slidingTimeWindowTogglingStarted	M	N/A	Unit: minutes
slidingTimeWindowTogglingSettled	M	N/A	Unit: minutes

6.2.2.2.2.4 aAMRuleType = vendorSpecificRule

Parameter Name	Qualifier	Information type	Comment
vendor specific parameters	N/A	N/A	N/A

6.2.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
aAMRuleIdentifier	M	N/A	See §5.5.1
status	M	ENUM (Success, Failure, aAMRuleAlreadyActive)	

6.2.2.4 Pre-condition

AAMIsSupported

Assertion Name	Definition
aAMIsSupported	The AAM functionality is supported by the IRPAgent.

6.2.2.5 Post-condition

AAMRuleIsApplied

Assertion Name	Definition
aAMRuleIsApplied	The AAM rule is applied. For the consequences see the definitions in Annex A.

6.2.2.6 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.

6.2.3 Operation getAAMRules (M)

6.2.3.1 Definition

This operation allows an IRPManager to request from the IRPAgent a list of activated AAMRules.

6.2.3.2 Input parameters

None

6.2.3.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment

aAMRuleList	M	LIST of aAMRuleInstance {
		
		aAMRuleInstance
		LIST OF {
		aAMRuleIdentifier,
		aAMRuleType,
		aAMRuleParameterList,
		filter
		}
		
		aAMRuleType
		ENUM (
		thresholdRule,
		toggleRule,
		transientRule,
		vendorSpecificRule
		)
		
		aAMRuleParameterList:
		Content type depends on the value of aAMRuleType (see §6.2.2)	

Status	M	ENUM (Success, Failure)	If no rule is defined, an empty advancedAlarmManagement RuleList a shall be delivered and status==Success.

6.2.3.4 Pre-condition

None

6.2.3.5 Post-condition

allActiveAdvanceAlarmManagementRulesAreDelivered

Assertion Name	Definition
allActiveAlarmManagementRulesAreDelivered	All active AAM rules are listed in the output.

6.2.3.6 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.

6.2.4 Operation deactivateAAMRule (M)

6.2.4.1 Definition

This operation allows an IRPManager to request the IRPAgent to deactivate one or all activated AAMRules.

Deactivated rules are not visible for the IRPManager.

6.2.4.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
advancedAlarmManagementRuleIdentifier	M	See 32.302 [3]	If this parameter contains no information, then all active AAM Rules shall be deactivated.

6.2.4.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
status	M	ENUM (Success, SpecifiedRuleNotExisting, Failure)	If input parameter advancedAlarmManagementRuleIdentifier is present and no such rule exists, then status== SpecifiedRuleNotExisting. If input parameter advancedAlarmManagementRuleIdentifier is not present and no rule is defined, then status==Success.

6.2.4.4 Pre-condition

None

6.2.4.5 Post-condition

allOrSpecifiedActiveAdvanceAlarmManagementRulesAreDeactivated

Assertion Name	Definition
allOrSpecifiedActiveAdvanceAlarmManagementRulesAreDeactivated	Depending on the input all or only the specified active AAM Rule are/is deactivated

6.2.4.6 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.

Annex A (normative): Advanced Alarm Management Rules

A.1 General

It is not recommended to have several AAMRules applicable at one time for one event. However, if `YyyFunction` supports and allows it, then it is vendor specific which AAMRule is applied or not.

An AAMRule (called Rule hereafter) contains multiple elements.

The first element (`subSection` titled: Criterion to determine alike alarm) is a criterion used to determine if an alarm is classified as 'alike' or "not alike". If the alarm is not-alike, then the alarm is not subject to further scrutiny (processing) by the Rule, i.e. it would be processed as if there is no Rule in effect. The `IRPManager` specifies such criterion in an input parameter named filter in various relevant AAM operations.

The second element (subSection titled: Treatment of alike alarm) is the algorithm to determine if

a) An alike alarm should be reported as one alarm (i.e. it is a significant alarm) or

b) The alike alarm should be suppressed (i.e. it is an insignificant alarm).

When a significant alarm is identified, the algorithm also determines:

a) The time when the notifyNew/Changed/ClearedAlarm of this significant alarm should be sent to `IRPManager` and

b) The value of alarmRaisedTime, alarmChangedTime and alarmClearedTime parameters in the relevant notifyNew/Changed/ClearedAlarm of this significant alarm.

The third element (subSection titled: Relation to Log and `AlarmList`) specifies which alarms shall enter into Log of LogIRP and `AlarmList` of AlarmIRP.

Each of the following subsections defines a Rule using the three-element description outlined above.

For each Rule, illustration samples, using symbols shown below, are given (titled: Samples). The thick horizontal line indicates a time-line. The dotted double-arrow line indicates a time parameter, if applicable. The '?' box indicates the alarm under investigation. The left-edge of a box corresponds to the alarmRaisedTime while the right-edge corresponds to the alarmClearedTime. So, the horizontal span of a box indicates the alarm active time span.

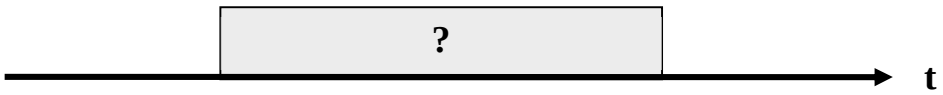


Figure A.1-1: Sample diagram notations

Sometimes, a shaded box is drawn below the time line as below. Such shaded box indicates the identification of a significant alarm (to be reported alarm).
The left-edge of the box indicates the time when the corresponding alarm notification is sent out. This emission time is not necessarily identical to the alarmRaised/ChangedTime within the alarm notification.
The right-edge of a box indicates the time when the corresponding alarm clearing notification is sent out. This emission time is not necessarily identical to the alarmClearedTime within the alarm notification.

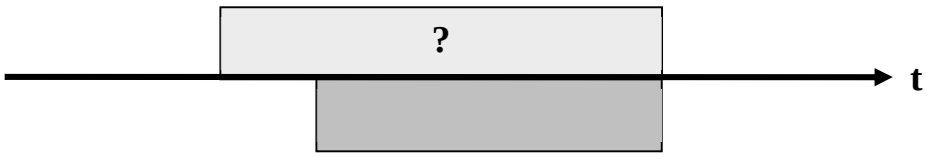


Figure A.1-2: Sample diagram notations

For each Rule, use cases are given (subSection titled: Example for Use cases).

For some Rules exception handling is defined (subSection titled: Exception Handling).

A.2 AAM Rules

A.2.1 Threshold Rule

A.2.1.1 Parameters

This Rule has three parameters, namely, the `alarmOccurenceThreshold` (called N here), the `slidingTimeWindow` (called T here) and filter.

A.2.1.2 Criterion to determine alike alarm

The filter parameter carries values for `objectInstance, alarmType, perceivedSeverity, probableCause` and `specificProblem`. If the alarm under investigation (e.g. the box with a '?' in the sample below) carries the same values, then it is considered 'alike' otherwise, "not-alike".

A.2.1.3 Treatment of alike alarm

Starting value for Lower Edge of Time Window is the activation time of the threshold rule.

Test an alike alarm.

When a new alarm matches the filter, then Lower and Upper Edge of Time Window and count are newly determined:
Upper Edge of Time Window becomes the time of the new alarm.
Lower Edge of Time Window becomes either the time of the current Lower Edge of Time Window or the time of the new alarm minus the default size T of the time window, whichever of these two times is later.

The count is the number of alarms between Lower and Upper Edge of Time Window (including the new alarm).
If the count reaches the threshold N, then the alarm is considered as significant and the Lower Edge of Time Window becomes the time of the alarm.

For a not reported alarm no `notifyClearedAlarm` shall be sent.

`NotifyClearedAlarms` for alarms which were reported to the `IRPManager` before the activation of the threshold rule shall not be suppressed.

Table A.2.1.3-1 shows the emission times of the various related to a significant alarm.

Table A.2.1.3-1: Significant alarm emission time for Threshold Rule

Reported alarm types	Emission (to IRPManager) times of a reported alarm
`notifyNewAlarm`	Immediately after the alarmRaisedTime.
`notifyChangedAlarm`	Immediately after the alarmChangedTime.
`notifyClearedAlarm`	Immediately after the alarmClearedTime

Table A.2.1.3-2 shows the time related parameters in significant alarm.

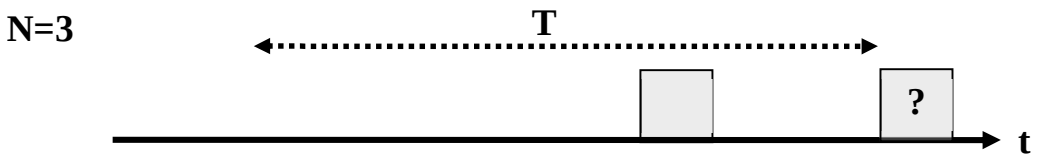
Table A.2.1.3-2: Significant alarm time parameters for Threshold Rule

Parameters of the Reported alarm	Parameter values
`alarmRaisedTime`	Same value as that carried in the alike alarm.
`alarmChangedTime`	Same value as that carried in the alike alarm.
`notifyClearedTime`	Same value as that carried in the alike alarm.
`alarmId`	Same value as that carried in the alike alarm.

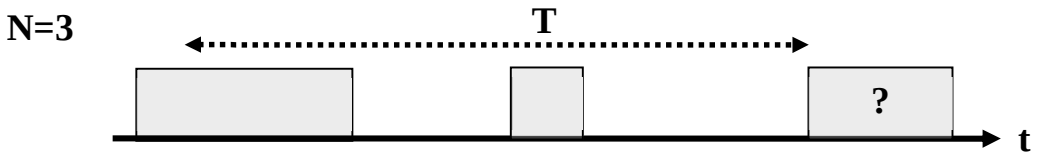
A.2.1.4 Relation to Log and AlarmList

The alike alarms enter the Log. The significant alarms enter the `AlarmList`.

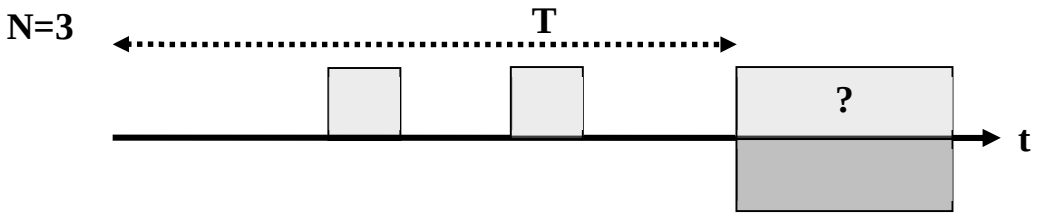
A.2.1.5 Samples



FigureA.2.1.5-1: Threshold Rule illustrations – insignificant alarm



FigureA.2.1.5-2: Threshold Rule illustrations – insignificant alarm



FigureA.2.1.5-3: Threshold Rule illustrations – significant alarm

A.2.1.6 Example for Use cases

The `thresholdRule` can be used to screen out alarms which are only important if they appear repeatedly, e.g. if an alarm which is self-healing comes back again and again,

A.2.2 Transient Rule

A.2.2.1 Parameters

This Rule has two parameters, namely, the minutesAtLeastActive (called T here) and filter.

A.2.2.2 Criterion to determine alike alarm

The filter parameter carries values for objectInstance, alarmType, perceivedSeverity, probableCause and specificProblem. If the alarm under investigation (e.g. the box with a '?' in the sample below) carries the identified parameters and having the same values, then it is considered 'alike' otherwise, "not-alike".

A.2.2.3 Treatment of alike alarm

Take an alike alarm. If it's period is smaller than T, then it is an insignificant alarm; otherwise, it is a significant alarm. For a not reported alarm no notifyClearedAlarm shall be sent.

NotifyClearedAlarms for alarms which were reported to the `IRPManager` before the activation of the transientRule shall not be suppressed.

Table A.2.2.3-1 shows the emission times of the various related to significant alarm.

Table A.2.2.3-1: Significant alarm emission time re: Transient Rule

Reported alarm type	Emission (to `IRPManager`) times of an Reported alarm
`notifyNewAlarm`	Immediately after the alarmRaisedTime plus T.
`notifyChangedAlarm`	Immediately after the alarmChangedTime plus T.
`notifyClearedAlarm`	Immediately after the alarmClearedTime

Table A.2.2.3-2 shows the time related parameters in significant alarm.

Table A.2.2.3-2: Significant alarm time parameters re: Transient Rule

Parameters of the Reported alarm	Parameter values
`alarmRaisedTime`	Same value as that carried in the alike alarm.
`alarmChangedTime`	Same value as that carried in the alike alarm.
`notifyClearedTime`	Same value as that carried in the alike alarm
`alarmId`	Same value as that carried in the alike alarm.

A.2.2.4 Relation to Log and AlarmList

The alike alarms enter the Log. The significant alarms enter the `AlarmList`.

A.2.2.5 Samples

Here are two samples. One is a not-to-be reported alarm while the other is a significant alarm.

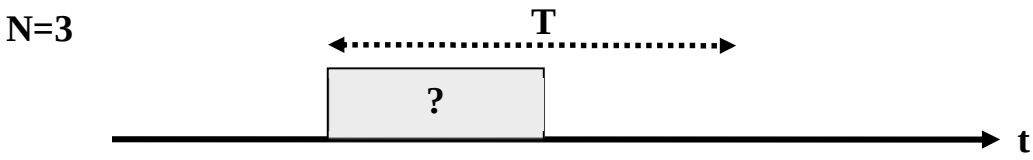


Figure A.2.2.5-1: TransientRule Illustrations – insignificant alarm

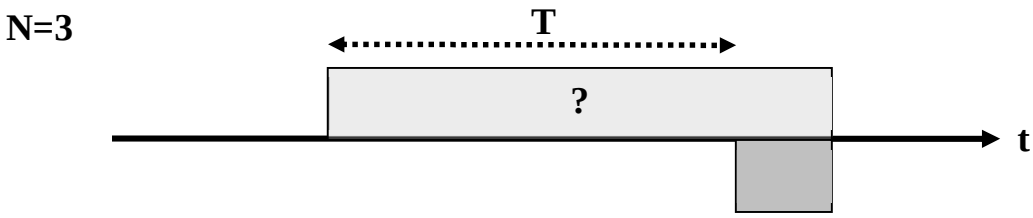


Figure A.2.2.5-2: TransientRule Illustrations – significant alarm

A.2.2.6 Example for Use cases

The transientRule can be used to screen out alarms which usually are of temporarily nature.

A.2.3 Toggle Rule

A.2.3.1 Parameters

This Rule has 4 parameters, namely, the filter, the alarmOccurenceThreshold (called N here), the slidingTimeWindowTogglingStarted (called T1 here) and slidingTimeWIndowTogglingSettled (called T2 here).

A.2.3.2 Criterion to determine alike alarm

The filter parameter carries values for objectInstance, alarmType, perceivedSeverity, probableCause and specificProblem. If the alarm under investigation (e.g. the box with a '?' in the sample below) carries the identified parameters and having the same values, then it is considered 'alike' otherwise, "not-alike".

A.2.3.3 Treatment of alike alarm

1. Starting values:

Starting value for Lower Edges of Time Windows for Toggling Started/Settled is the activation time of the toggle rule.
Starting value for the count is zero.
At the beginning all alarms are "non-toggling"

2. To do when alike alarm was identified

When a notifyNew/Changed/ClearedAlarm event matches the filter, then Lower and Upper Edge of the Time Window TogglingStarted/Settled and count are newly determined:

2.1. Determine Time Window TogglingStarted
Upper Edge of Time Window TogglingStarted becomes the time of the event.
Lower Edge of Time Window TogglingStartedbecomes the time of the event minus the size T1 of the time window.

2.2. Determination of "toggling" (via count)
The count is the number of alike alarms between Lower and Upper Edge of Time Window TogglingStarted (including the new alarm).
If the count is above or equal to the threshold N and the event was a notifyNewAlarm and the alarm was "non-toggling", then the notifyNewAlarm is sent and the alarm is considered as "toggling", with the consequence that further alike notifyNew/Changed/Alarm events are regarded as not significant, until the alarm is considered as "non-toggling" again.

2.3.Determine Time Window TogglingSettled
If the alarm is "non-toggling", then there is no need to determine Upper and Lower Edge of Time Window TogglingSettled.
If the alarm is "toggling", then:
Upper Edge of Time Window TogglingSettled becomes the time of the new event plus the size T2 of the Time Window TogglingSettled .
Lower Edge of Time Window TogglingSettled becomes the time of the new alarm .

3. Return to non-toggling
If the time reaches the Upper Edge of Time Window TogglingSettled, then the alarm is considered as "non-toggling", i.e. alike alarms are regarded as significant.
If the last event was a notifyChanged/ClearedAlarm, then the change to "non-toggling" triggers the emission of the related notification.

Table A.2.3.3-1 shows the emission times of the various related to significant alarm.

Table A.2.3.3-1: Significant alarm emission time re: Toggle Rule

Reported alarm types	Emission (to IRPManager) times of an Reported alarm
`notifyNewAlarm`	Immediately after the alarmRaisedTime
`notifyChangedAlarm`	Immediately after the alarmChangedTime [Remark: If the alarm is toggling state, then the notifyChangeAlarm is dropped (not significant).]
`notifyClearedAlarm`	Immediately after the alarmClearedTime+T2 of the last alike alarm , if alarmClearedTime is earlier than alarmRaisedTime+T2 or immediately after the alarmClearedTime of the last alike alarm, if this time is later than or equal to alarmRaisedTime+T2

Table A.2.3.3-2 shows the time related parameters in significant alarm.

Table A.2.3.3-2: Significant alarm time parameters re: Toggle Rule

Parameters of the Reported alarm	Parameter values
`alarmRaisedTime`	Same value as that carried in the alike alarm.
`alarmChangedTime`	Same value as that carried in the alike alarm.
`notifyClearedTime`	Same value as that carried in the last alike alarm.
`alarmId`	Same value as that carried by the first member of a sequence.

A.2.3.4 Relation to Log and AlarmList

The alike alarms enter the Log. The significant alarms enter the `AlarmList`.

A.2.3.5 Samples

The samples below use N=3.

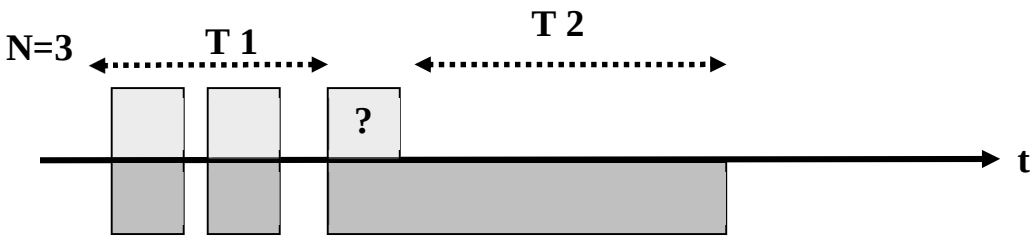


Figure A.2.3.5-1: Toggle Rule illustration 1

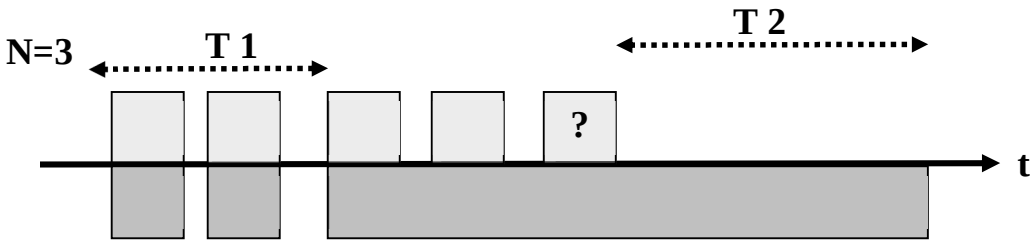


Figure A.2.3.5-2: Toggle Rule illustration 2

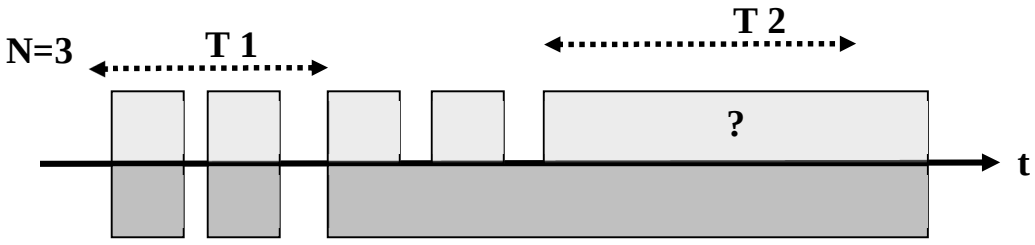


Figure A.2.3.5-3: Toggle Rule illustration 3

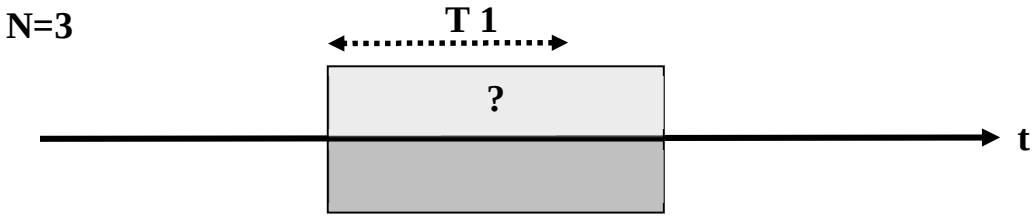


Figure A.2.3.5-4: Toggle Rule illustration 4

A.2.3.6 Example for Use cases

The toggleRule can be used to take some burden from alarm management for cases where an alarm comes and goes back and forth, e.g. because of some entity is in a swinging state.

A.2.3.7 Exception Handling

The Toggle Rule can potentially group multiple alike alarms together to form one significant alarm. If the process executing the Rule misses the alarm clearing time of one member of a group, then this can have the following consequences:

If a clearing of one of the alike alarms during the toggling state is missed (green box in Figure A.2.3.7-1), then the significant alarm would also not be cleared (pink box continuing the dark grey in the same figure). This can be avoided if the filter is set in a way that only alarms of one instance will pass it and if always the latest notifyClearedAlarms triggers the start of T2.

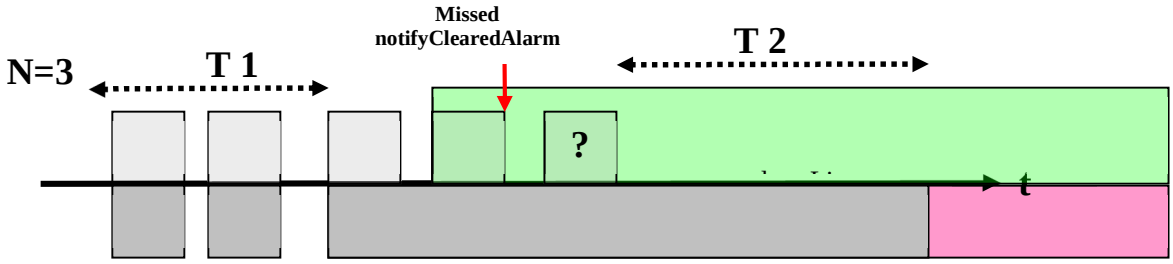


Figure A.2.3.7-1: Exception handling example

A.2.4 Definition of vendor specific rule

It is possible to implement vendor specific `AAMRules`. No specific definitions are supplied here.

A.3 Relation of Rule and Notification filter

This clause illustrates the relation between the AAM capabilities and the NotificationIRP and AlarmIRP.

The following diagram illustrates the case when AAM capabilities are not deployed. The "1, 2.. 6" indicates 6 alarms. They will be logged and they would appear in the `AlarmList`. The NotificationIRP supported a filter F1.
The `IRPManager`, in this case, receives "1, 3" where ‘2, 4, 5, 6’ were discarded because of Notification filter F1 is in effect.

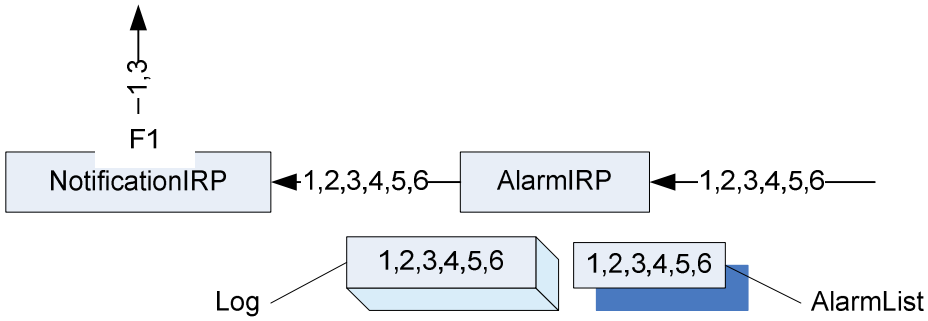
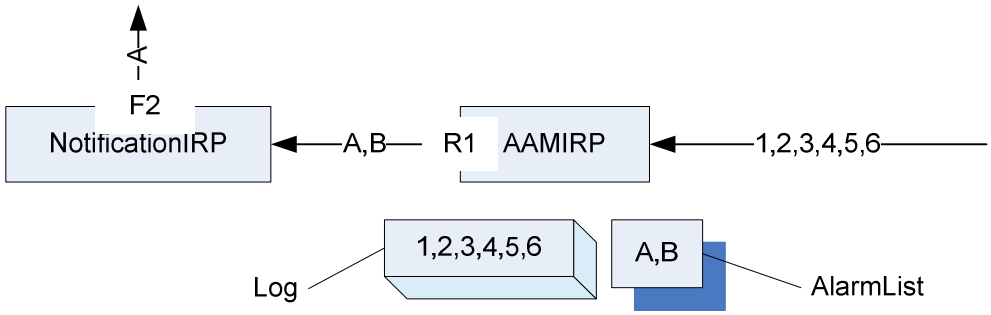


Figure A.3-1: Deployment without AAM capabilities

The following diagram illustrates the case when AAM capabilities are deployed. The "1, 2.. 6" indicates 6 alarms. They will be logged. Because of AAMRule R1 is in effect, the ""1,2…6" result in two significant alarms, A and B. The A and B will appear in `AlarmList`. They will also be broadcasted to `IRPManager`s subject to NotificationIRP filter in effect. In the case below, the `IRPManager` would receive only A because Notification IRP filter F2 is in effect.



FigureA.3-2: Deployment with AAM capabilities

Annex B (informative): Change history

Change history								
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Cat**	**Old**	**New**
Sep 2007	SA_37	SP-070616	--	--	Submitted to SA#37 for Information	--	1.0.0	
Mar 2008	SA_39	SP-080072	--	--	Submitted to SA#39 for Approval	--	2.0.0	8.0.0
Jun 2008	SA_40	SP-080329	0001	--	Clarify the assumed scenarios for AAM rules	F	8.0.0	8.1.0
Dec 2009	-	-	-	-	Update to Rel-9 version (MCC)	-	8.1.0	9.0.0
Mar 2011	-	-	-	-	Update to Rel-10 version (MCC)	-	9.0.0	10.0.0
Sep-2012	SA_57	SP-120645	0005	1	Clean-up of AAM IRP Information Service	D	10.0.0	11.0.0
2014-10	-	-	-	-	Update to Rel-12 version (MCC)		11.0.0	**12.0.0**
2016-01	-	-	-	-	Update to Rel-13 version (MCC)		12.0.0	**13.0.0**
2017-03	SA#75	-	-	-	Promotion to Release 14 without technical change		13.0.0	**14.0.0**

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-06						Update to Rel-15 version (MCC)	15.0.0

History

Document history		
V15.0.0	July 2018	Publication