Technical Specification Group Services and System Aspects
Meeting #8, Düsseldorf, Germany, 26-28 June 2000

TSGS#8(00)0242

Source: **SA5 (Telecom Management)**

Title: **32.106 CR, "Split of TS - Part 2: Notification Integration Reference Point (IRP): Information Service (IS)" (S5-000324)**

Document for: **Approval**

Agenda Item: **6.5.3**

SA5 has split TS 32.106 Configuration Management (CM) into a multi-part TS as identified below:

Part 1: "3G Configuration Management";

Part 2: "Notification IRP Information Service";

Part 3: "Notification IRP CORBA Solution Set";
Part 4: "Notification IRP CMIP Solution Set";
Part 5: "Basic Configuration Management IRP Information Model (including NRM)";
Part 6: "Basic Configuration Management IRP CORBA Solution Set";
Part 7: "Basic Configuration Management IRP CMIP Solution Set"
Part 8: "Name Convention for Managed Objects"

Five (5) CRs are submitted to SA#8 for approval; the present one is highlighted in yellow:

Spec	CR	Phase	Subject	Cat	Version - Current	Version -New	Doc-2nd-Level
32.106	001	R99	Split of TS - Part 1: Main part of spec - Concept and Requirements	F	3.0.1	3.1.0	S5-000323
32.106	002	R99	Split of TS - Part 2: Notification IRP Information Service (IS)	F	3.0.1	3.1.0	S5-000324
32.106	003	R99	Split of TS - Part 3: Notification IRP CORBA SS	F	3.0.1	3.1.0	S5-000325
32.106	004	R99	Split of TS - Part 4: Notification IRP CMIP SS	F	3.0.1	3.1.0	S5-000326
32.106	005	R99	Split of TS - Part 8: Name Convention for Managed Objects	F	3.0.1	3.1.0	S5-000327

3GPP TSG-SA5 (Telecom Management)
Meeting #12, Rome, 5–9 June 2000

SA5#12(00)324

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

32.106	CR	002	Current Version:	3.0.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [X]

Source: SA5#12 **Date:** 20 June 2000

Subject: Split of TS - Part 2: Notification Integration Reference Point (IRP): Information Service (IS)

Work item: 32.106 Configuration Management

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: A (large) number of minor technical corrections and clarifications of this IRP that have been agreed by SA5. Some terms have also been slightly changed to be more clear and consistent with other SA5 specifications.

Clauses affected: Introduction; clause 1-6.

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

3G TS 32.106-2 V3.0.1da (2000-064)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Part 2: Notification Integration Reference Point: Information Service Version 1 (Release 1999)

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Contents

Foreword

This Technical Specification (TS) 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;

2 presented to TSG for approval;

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

Configuration Management (CM), in general, provides the operator with the ability to assure correct and effective operation of the 3G network as it evolves. CM actions have the objective to control and monitor the actual configuration on the NEs and NRs, and they may be initiated by the operator or functions in the OSs or NEs.

CM actions may be requested as part of an implementation programme (e.g. additions and deletions), as part of an optimisation programme (e.g. modifications), and to maintain the overall Quality of Service. The CM actions are initiated either as a single action on a network element of the 3G network or as part of a complex procedure involving actions on many network elements.

~~In this document, Clauses 4 through 6 are here provided to give an introduction and description of the main concepts of configuration management, which is not mandatory for the compliance to this specification in this release. Clause 7 contains the specific definitions for the standardised N interface, which are necessary to follow for compliance.~~

~~Clause 4 provides a brief background of CM while Clause 5 explains CM services available to the operator. Clause 6 breaks these services down into individual CM functions, which support the defined services. Clause 7 defines the N INTERFACEinterface to be used for 3G CM.~~

The Itf-N interface for Configuration Management is built up by a number of Integration Reference Points (IRPs) and a related Name Convention, which realise the functional capabilities over this interface. The basic structure of the IRPs is defined in [1] and [2]. For CM, a number of IRPs (and the Name Convention) are defined herein, used by this as well as other technical specifications for telecom management produced by 3GPP. All these documents are included in Parts 2-N the 3G TS 32.106.

This document consitutes 32.106 Part 2 (32.106-2) - Notification IRP Information Service.

1 Scope

~~The present document describes the Configuration Management (CM) aspects of managing a 3G network. This is described from the management perspective outlined in the two 3GPP specifications 32.101 [1] and 32.102 [2].~~

~~The present document defines a set of controls to be employed to effect set-up and changes to a 3G network in such a way that operational capability and quality of service, network integrity and system inter-working are ensured. In this way, the present document describes the interface definition and behaviour for the management of relevant 3G network NEs in the context of the described management environment. The context is described for both the management systems (OS) and NE functionality.~~

~~Clause 7 contains the specific definitions for the standardised N-interface, which are necessary to follow for compliance to this specification.~~

Network elements (NEs) under management generate events to inform event receivers about occurrences within the network that may be of interest to event receivers. There are a number of categories of events. Alarm, as specified in Alarm IRP: Information Service [1], is one member of this category.

The purpose of Notification IRP is to define an interface through which an IRPManager (typically a network management system) can subscribe to IRPAgent (typically a NE IRPManager (EM) or a NE) for receiving network events. It also specifies attributes carried in the network events. These attributes are common among all event categories. Attributes that are specific to a particular event category are not part of this specification. For example, `perceivedSeverity` is an attribute specific for alarm event category. This attribute is not defined here but in Alarm IRP [1].

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] 3G TS 32.111-2: “Alarm IRP: Information Service”

[2] Intentionally left blank

[3] ITU-T Recommendation X.734 (09/92) - Information technology - Open Systems Interconnection - Systems management: Event report management function

[4] 3G TS 32.106-8 : “Name Convention for Managed Objects”

[5] Intentionally left blank

[6] OMG Notification Service

[7~~1~~] 3G TS~~PP~~ 32.101: "3G Telecom Management principles and high level requirements".

[8~~2~~] 3G TS~~PP~~ 32.102: "3G Telecom Management architecture".

[9] 3G TS 32.106-1: “3G Configuration Management”

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply. For terms and definitions not found here, please refer to [7],[8] and [9].

IRPAgent: See [8].

IRPManager: See [8].

Event: It is an occurrence that is of significance to network operators, the network elements under surveillance and network management applications. Events can indicate many types of network management information, such as network alarms, network configuration change information and network performance data.

Extended Event Type: ITU-T TMN defines event types. They are: Object Creation, Object Deletion, Attribute Value Change, State Change, Relationship Change, Communications Alarm, Processing Error Alarm, Environmental Alarm, Quality of Service Alarm, Equipment Alarm, Integrity Violation, Security Violation, Time Domain Violation, Operational Violation, Physical Violation. Valid values of this set are controlled by ITU-T.

SA5 IRP work requires definitions beyond those ITU-T defined event types. Examples are:

- Indicate alarm acknowledgement state changes.
- Indicate Alarm List (defined in Alarm IRP: IS [1]) has rebuilt successfully.

This set is called `extendedEventType`. Valid values for this set are specified by this IRP.

Notification: It refers to the transport of events from event producer to consumer (receiver). In this IRP, notification is used to carry network events from IRPAgent to IRPManager. Producer sends notifications to consumers as soon as there are new events occur. Consumer does not need to check ("pull") for events.

It may be reused if there is no requirement that the previous notification using that Notification identifier be correlated with future notifications. Generally, IRPAgent should choose it to ensure uniqueness over as long a time as is feasible for the IRPAgent.

Notification Category: One Notification Category defines the set of all event types and all extended event types specified by one IRP. Neither an event type nor an extended event type may belong to more than one Notification Category.

~~**Data:** is any information or set of information required to give software or equipment or combinations thereof a specific state of functionality~~

~~**Element Manager (EM):** provides a package of end-user functions for management of a set of closely related types of network elements. These functions can be divided into two main categories:~~

- ~~*Element Management Functions* for management of network elements on an individual basis. These are basically the same functions as supported by the corresponding local terminals.~~
- ~~*Sub-Network Management Functions* that are related to a network model for a set of network elements constituting a clearly defined sub-network, which may include relations between the network elements. This model enables additional functions on the sub-network level (typically in the areas of network topology presentation, alarm correlation, service impact analysis and circuit provisioning).~~

~~**Equipment:** is one or more hardware items which correspond to a manageable or supervisable unit or is described in an equipment model~~

~~**Firmware:** is a term used in contrast to software to identify the hard-coded program, which is not downloadable on the system~~

~~**Hardware:** is each and every tangible item~~

IRP Information Model: See [1].

IRP Information Service: See [1].

IRP Solution Set: See [1].

Managed Object (MO): an abstract entity which may be accessed through an open interface between two or more systems, and representing a Network Resource for the purpose of management. The MO is an instance of a Managed Object Class (MOC) as defined in a Management Information Model (MIM). The MIM does not define how the MO or NR is implemented; only what can be seen in the interface

Managed Object Class (MOC): a description of all the common characteristics for a number of MOs, such as their attributes, operations, notifications and behaviour

Managed Object Instance (MOI): an instance of a MOC, which is the same as a MO as described above

Management Information Base (MIB): the set of existing managed objects in a management domain, together with their attributes, constitutes that management domain's MIB. The MIB may be distributed over several OS/Nes

Management Information Model (MIM): also referred to as NRM – see the definition below. There is a slight difference between the meaning of MIM and NRM – the term MIM is generic and can be used to denote any type of management model, while NRM denotes the model of the actual managed telecommunications network resources

Network Element: is a discrete telecommunications entity, which can be, managed over a specific interface e.g. the RNC

Network Manager (NM): provides a package of end-user functions with the responsibility for the management of a network, mainly as supported by the EM(s) but it may also involve direct access to the network elements. All communication with the network is based on open and well-standardized interfaces supporting management of multi-vendor and multi-technology network elements

Network Resource: is a component of a Network Element which can be identified as a discrete separate entity and is in an object oriented environment for the purpose of management represented by an abstract entity called Managed Object

Network Resource Model (NRM): a model representing the actual managed telecommunications network resources that a System is providing through the subject IRP. An NRM describes managed object classes, their associations, attributes and operations. The NRM is also referred to as "MIM" (see above) which originates from the ITU-T TMN

Object Management Group (OMG): see http://www.omg.org

Operations System (OS): indicates a generic management system, independent of its location level within the management hierarchy

Operator: is either

- a human being controlling and managing the network; or
- a company running a network (the 3G network operator)

Optimisation: of the network is each up-date or modification to improve the network handling and/or to enhance subscriber satisfaction. The aim is to maximise the performance of the system

Re-configuration: is the re-arrangement of the parts, hardware and/or software that make up the 3G network. A re-configuration can be of the parts of a single NE or can be the re-arrangement of the NEs themselves, as the parts of the 3G network. A re-configuration may be triggered by a human operator or by the system itself

Reversion: is a procedure by which a configuration, which existed before changes were made, is restored

Software: is a term used in contrast to firmware to refer to all programs which can be loaded to and used in a particular system

Up-Dates: generally consist of software, firmware, equipment and hardware, designed only to consolidate one or more modifications to counter-act errors. As such, they do not offer new facilities or features and only apply to existing Nes

~~**Up-Grades:** can be of the following types:~~

- ~~enhancement - the addition of new features or facilities to the 3G network;~~
- ~~extension - the addition of replicas of existing entities.~~

3.2 Abbreviations

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

CM	Configuration Management
~~CMIP~~	~~Common Management Information Protocol~~
CORBA	Common Object Request Broker Architecture
EM	Element Manager
FM	Fault Management
~~FW~~	~~Firmware~~
~~HW~~	~~Hardware~~
IDL	Interface Definition Language
IRP	Integration Reference Point
ITU-T	International Telecommunication Union, Telecommunication Standardisation Sector
MIB	Management Information Base
MIM	Management Information Model
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NM	Network Manager
NR	Network Resource
NRM	Network Resource Model
OMG	Object Management Group
TMN	Telecommunications Management Network
~~OS~~	~~Operations System~~
~~OSF~~	~~Operations System Function~~
~~SW~~	~~Software~~
~~TRX~~	~~Transceiver~~
TS	Technical Specification
UML	Unified Modelling Language (OMG)

~~4 Notification Integration Reference Point: Information Service~~

4 System Overview

4.1 System context for Notification

The following figures identify System contexts of Notification IRP in terms of implementations called IRPAgent and IRPManager.

"IRPManager" depicts a process that interacts with IRPAgent for the purpose of receiving network Notifications via this IRP. IRPAgent detects network events. IRPAgent sends IRPManagers notifications carrying the events. Examples of IRPManagers can be a process running supporting network Notification logging device or supporting network Notification viewing devices (such as a local craft terminal) or a process running within a Network IRPManager (NM) as shown in Figure 1 and Figure 2. IRPAgent implements and supports this IRP. IRPAgent can run within one Element

Manager (EM) with one or more NEs (see Figure 1) or run within one NE (see Figure 2). In the former 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 IRP, one cannot deduce if EM and NE are integrated in a single system or if they run in separate systems.

Figure 11: System Context A

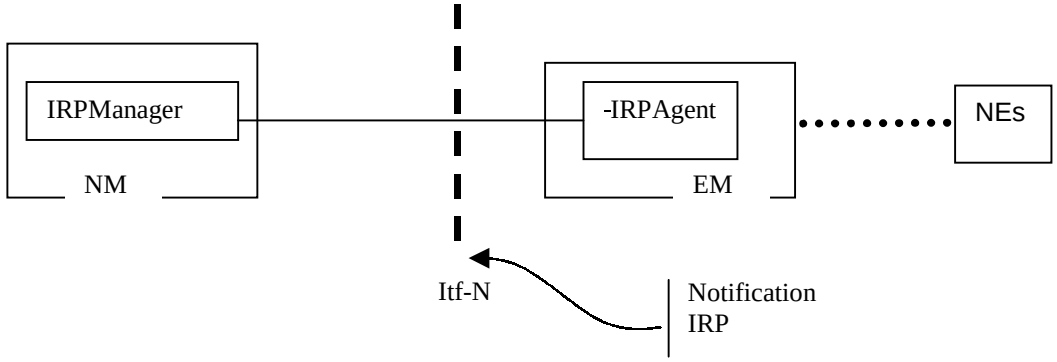
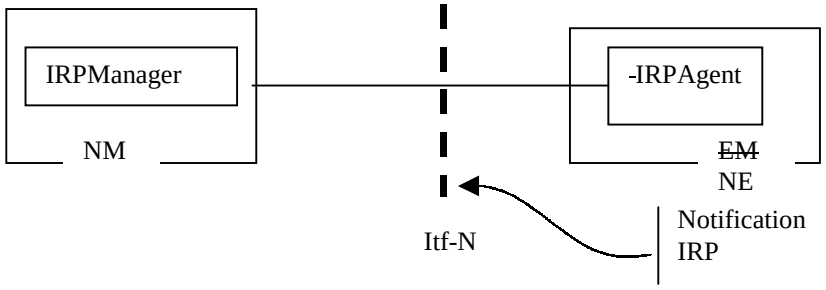


Figure 22: System Context B



This interface supports the following implementation strategies.

- One IRPAgent supports emission of different categories of Notifications, such as alarms (as specified in [1]) and others.
- One IRPAgent supports emission of one specific category of Notification. For example, one IRPAgent implementation only emits alarms specified in [1]. Another IRPAgent implementation emits configuration status change notifications.
- IRPManager can specify the categories of notifications it wants to receive using `subscribe` operation. In the case IRPManager does not specify the notification category in `subscribe`, IRPAgent will then emit all categories of notifications that IRPAgent handles. This implementation is SS dependent.
- IRPManager can query the categories of notification supported by IRPAgent. This implementation is SS dependent.

The Notification IRP defines attributes, carried in notifications that are common in all categories of notifications. Attributes specific to a particular category of notification shall be specified in corresponding IRP (such as Alarm IRP). Those IRP also defines the protocol interaction via which IRPManager receives the notifications.

5 Modelling Approach

This section identifies the modelling approach adopted and used in this IRP.

This IRP bases its design on work captured in ITU-T Recommendation X.734 [3], OMG Notification Service [6]. The central design ideas are:

- Separation of notification Consumers (IRPManagers) from Producers (IRPAgents);
- Notifications are sent to IRPManagers without the need for IRPManagers to periodically check for new notifications.
- Common characteristics related to notifications in all other IRPs are gathered in one IRP (this document).

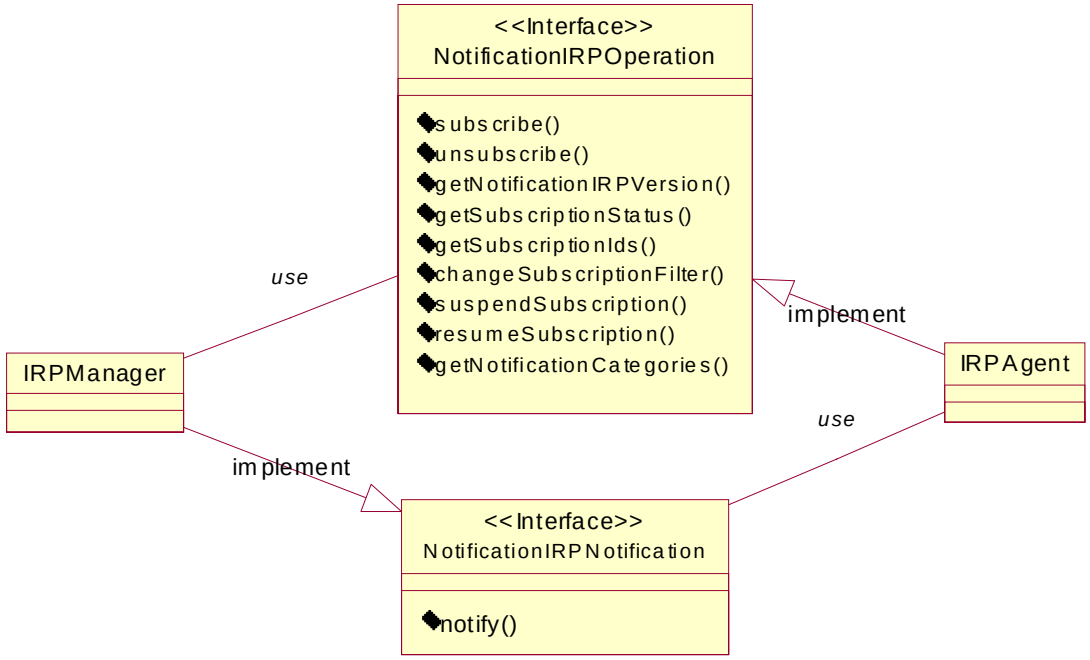
6 IRP Information Service

6.1 Interfaces

The following figure illustrates the operations and notifications defined as interfaces implemented and used by IRPAgent and IRPManager. Parameters and return status are not indicated. Interface in IRP Information Service is identical to concept conveyed by stereotype <<`interface`>> of UML.

One interface, called `NotificationIRPOperations`, is defined. This interface defines operations implemented by IRPAgent and used (or called by) IRPManager.

Figure 33: Protocol Independent Interface



6.1.1 NotificationIRPOperation Interface

6.1.1.1 Operation `subscribe` (M)

IRPManager invokes this operation to establish subscription to receive network events via notifications, under the filter constraint specified in this operation. How IRPManager discovers the IRPAgent's address or reference (so that IRPManager can invoke this operation) is outside the scope of this document.

Table 11: Parameters of `subscribe`

Name	Qualifier	Purpose
`managerReference`	Input, M	It specifies the reference of IRPManager to which IRPAgent shall send events.
`timeTick`	Input, O	It specifies the value of a timer hold by IRPAgent for the subject IRPManager. This value defines a time window within which IRPManager intends to invoke `getSubscriptionStatus` (or `subscribe`) operation. IRPAgent shall reset the timer, with `timeTick`, when it receives the `getSubscriptionStatus` (or `subscribe`) operation from the subject IRPManager. If the timer expires, IRPAgent may delete its resources allocated to the IRPManager and consider IRPManager as if it has invoked `unsubscribe` operation. In such case, IRPManager will not receive further notification. IRPManager needs to invoke `subscribe` operation again. The value is in unit of whole minute. If the value is between 1 and 15, IRPAgent considers it to be 15. If the parameter is absent or if the parameter is present but its value is negative or 0, IRPAgent shall treat `timeTick` value as infinite, i.e., timer will never expire and IRPAgent needs other means to decide when to delete resources allocated to the IRPManager.
`notification Categories`	Input, O	It identifies one or more Notification Categories (see also definition in subclause 3.1). If the parameter is absent, IRPAgent shall consider IRPManager is subscribing to all notification categories supported by IRPAgent.
`filter`	Input, O	It specifies a filter constraint that IRPAgent shall use to filter notification of the category specified in `notificationCategory` parameter. IRPAgent shall notify IRPManagers if the event satisfies the filter constraint. If this parameter is absent, then no filter constraint shall be applied. Valid filter constraint grammars are specified by individual notification IRP SS, e.g. Notification IRP: CORBA SS.
`subscriptionId`	Output, M	It holds an unambiguous identity of this subscription. IRPManager can invoke operations (e.g., `suspendSubscription`) using this identity. In normal usage, IRPManager shall not provide this identity to another IRPManager such that the second IRPManager can invoke operations using it.
`status`	Output, M	(a) Operation succeeded in that the requested subscription has been established successfully AND that IRPAgent is emitting categories of notification specified by IRPManager via the `notificationCategory` parameter AND that the `filter`, if present, contains a valid filter constraint. (b) Operation failed because IRPManager is already in subscription, i.e., IRPAgent detects that there is an existing

		subscription carrying the same `managerReference` and in subscription for the same `notificationCategory`. (c) Operation failed because of other specified or unspecified reason.

6.1.1.2 Operation `unsubscribe` (M)

IRPManager invokes this operation to cancel subscription. IRPManager shall supply the `subscriptionId` assigned by IRPAgent in the corresponding operation `subscribe`.

Table 22: Parameters for `unsubscribe`

Name	Qualifier	Purpose
`manager Reference`	Input, M	It specifies the reference of IRPManager. IRPManager shall supply its valid `managerReference`. This is the necessary requirement for the operation to be successful.
`subscriptionId`	Input, O	It carries the `subscriptionId` carried as the OUT parameter in the `subscribe` operation. IRPManager shall supply a specific `subscriptionId` if IRPManager wants to unsubscribe that particular subscription. IRPManager shall not supply `subscriptionId` (the parameter is absent) if it wants to unsubscribe all subscriptions established between IRPAgents and this `managerReference`.
`status`	Output, M	(a) Operation succeeded in that subscription is cancelled successfully. (b) Operation failed because of specified or unspecified reason.

6.1.1.3 Operation `getNotificationIRPVersion` (M)

IRPManager wishes to find out the Notification IRP SS versions supported by IRPAgent. IRPAgent shall respond with a list of Notification IRP SS version(s).

Table 33: Parameters for `getNotificationIRPVersion`

Name	Qualifier	Purpose
`versionNumberList`	Output, M	It indicates one or more SS version numbers supported by the IRPAgent. This shall contain only one version number. See paragraph of this sub-clause.
`status`	Output, M	(a) Operation succeeded in that `versionNumberList` contains valid result. (b) Operation failed. Output parameter `versionNumberList` may contain invalid result.

6.1.1.4 Operation `getSubscriptionStatus` (O)

IRPManager invokes this operation to query the subscription status of a particular subscription.

IRPManager can get similar service by invoking `subscribe` operation. However, the following differences are noted.

- Operation subscribe uses managerReference and this operation uses subscriptionId.
- If IRPAgent has lost IRPManager's reference, IRPManager use of subscribe operation may result in establishment of another subscription. Using this operation does not establish another subscription.
- IRPManager can use getSubscriptionStatus operation to know about the filter constraint in effect, the state of subscription (i.e., if subscription is suspended/inactive or resumed/active), the timeTick value that may be set at subscribe invocation time and the notificationCategory currently in used in the subscription.

Table 44: Parameters for `getSubscriptionStatus`

Name	Qualifier	Purpose
`subscriptionId`	Input, M	It carries the `subscriptionId` carried as the output parameter in the `subscribe` operation.
`notificationCategoryList`	Output, M	It identifies the notificationCategory or notificationCategories supported in this subscription.
`filterInEffect`	Output, O	It contains the filter constraint currently active. If it is absent, IRPManager shall not apply any filter constraint to notifications emitted towards the subject IRPManager.
`subscriptionState`	Output, O	It indicates if the subscription is in "`suspended`" or "`not-suspended`".
`timeTick`	Output, O	It carries the same value as the one in `subscribe` operation.
`status`	Output, M	(a) Operation is successful and IRPAgent has valid values for all output parameters (b) Operation is unsuccessful in that IRPAgent has no knowledge of the subscription.

6.1.1.5 Operation `getSubscriptionIds` (O)

IRPManager invokes this operation to get the values of all still valid `subscriptionIds` assigned by IRPAgent as result of previously `subscribe` operations performed by this IRPManager.

Table 55: Parameters for `getSubscriptionIds`

Name	Qualifier	Purpose
`managerReference`	Input, M	It specifies the reference of IRPManager that requests the list of identifiers of active subscriptions related to this IRPManager.
`subscriptionIdList`	Output, M	It carries a list of the `subscriptionId`, each assigned as OUT parameter in previous `subscribe` operations invoked by the current IRPManager. This value should contain no information if the IRPManager did not yet subscribed to that System or System lost all subscription related information.
`status`	Output, M	(a) Operation succeeded in that the value contained in OUT parameter is valid. (b) Operation failed because subscription information is lost or IRPAgent cannot complete the operation for other reasons. In this case, the OUT parameter shall contain no information.

6.1.1.6 Operation changeSubscriptionFilter (O)

IRPManager invokes this operation to replace the present filter constraint with a new one.

Table 66: Parameters for changeSubscriptionFilter

Name	Qualifier	Purpose
subscriptionId	Input, M	It carries the subscriptionId carried as the OUT parameter in the subscribe operation
filter	Input, M	See description of Table 1: Parameters of subscribe.
status	Output, M	(a) Operation succeeded in that IRPAgent is now producing events based on the new filter constraint. (b) Operation failed in that, for unspecified reason, the new filter constraint cannot be installed. The old filter constraint, if present before this operation, is still in effect.

6.1.1.7 Operation suspendSubscription (O)

IRPManager invokes this operation to request IRPAgent to stop emission of notifications. IRPAgent may lose notification(s) if subscription is suspended.

Table 77: Parameters for suspendSubscription

Name	Qualifier	Purpose
subscriptionId	Input, M	It carries the subscriptionId carried as the OUT parameter in the subscribe operation
status	Output, M	(a) Operation succeeded in that IRPAgent has suspended emission of notifications. (b) Operation failed in that, for unspecified reason, IRPAgent has not suspended emission of events.

6.1.1.8 Operation resumeSubscription (O)

IRPManager invokes this operation to request IRPAgent to resume emission of notifications. If the Subscription State is "not-suspended", IRPAgent shall return status successful and ignore this invocation. If Subscription State is "suspended", IRPAgent shall return status successful, change the Subscription State to "not-suspended" and resume emission of notifications.

Table 88: Parameters for resumeSubscription

Name	Qualifier	Purpose
subscriptionId	Input, M	It carries the subscriptionId carried as the OUT parameter in the subscribe operation.
status	Output, M	(a) Operation succeeded in that IRPAgent is has resumed emission of events. (b) Operation failed in that, for unspecified reason, IRPAgent cannot resume emission of events.

6.1.1.9 Operation `getNotificationCategories` (O)

IRPManager invokes this operation to query the categories of notification supported by IRPAgent. IRPManager does not need to be in subscription to invoke this operation.

Table 99: Parameters for `getNotificationCategories`

Name	Qualifier	Purpose
`notification CategoryList`	Output, M	It identifies the list of notification categories supported by IRPAgent (see also definition in subclause 3.1). If this parameter value contain no information, then the meaning is that IRPAgent does not support any notification category at the moment.
`eventTypeList`	Output, O	It contains a list of elements. Each element is a list of eventType. The number of element shall be identical to that of output parameter notificationCategoryList. The n-th element of this list relates to the n-th element of the notificationCategoryList. IRPAgent shall not use arbitrarily any eventType(s) in this n-th element. IRPAgent shall use the same list of eventType(s) specified in the IRP document identified by the n-th element of the notificationCategoryList. If the n-th element contains no information, it implies IRPAgent is not providing explicit identification of eventType(s) of the corresponding notificationCategory. If this parameter is absent or contains no information, it implies that IRPAgent is not providing explicit identification of eventType(s).
`extendedEvent TypeList`	Output, O	It contains a list of element. Each element is a list of extendedEventType. The number of element shall be identical to that of output parameter notificationCategoryList. The n-th element of this list relates to the n-th element of the notificationCategoryList. IRPAgent shall not use arbitrarily any extendedEventType in this n-th element. IRPAgent shall use the same list of extendedEventType specified in the IRP document identified by the n-th element of the notificationCategoryList. If the n-th element contains no information, it implies IRPAgent is not providing explicit identification of extendedEventType(s) of the corresponding notificationCategory. ~~(a)~~If this parameter is absent or contains no information, it implies that IRPAgent is not providing explicit identification of extendedEventType(s).
`status`	Output, M	~~(b)~~(a) Operation succeeded in that the output parameter contains valid information. ~~(c)~~(b) Operation failed in that the output parameter does not contain valid information.

6.1.2 NotificationIRPNotification Interface

6.1.2.1 Notification `notify`

IRPAgent notifies the subscribed IRPManager that an event has occurred and that the event has satisfies the filter constraints used for this subscription. One event example is the notification defined in Alarm IRP: IS [1].

This document does not further specify this `notify`. Other IRPs, such as Alarm IRP: IS [1], shall specify this `notify`, in particular, the specific parameters carried in notification, for use in their context.

This document shall specify, in subclause 6.1.2.2, attributes commonly carried in parameters of all notifications.

6.1.2.2 Notification Attributes

Information about network events is carried in notification containing parameters of multiple attributes. This IRP specifies attributes that are commonly found in notifications defined by other IRPs. Collectively, they are called Notification Header. Other IRPs, such as Alarm IRP [1], shall specify the attributes used in the notification including:

- Identification and qualification of notification Header attributes for their use;
- Specification and qualification of other attributes relevant for their use.

6.1.2.2.1 `managedObjectClass (M)`

This parameter specifies the class of the managed object in which the network event occurred. This attribute is filterable.

6.1.2.2.2 `managedObjectInstance` (M)

This parameter specifies the instance of the managed object in which the network event occurred. This attribute is filterable.

6.1.2.2.3 `notificationId` (O)

This parameter provides an identifier for the notification, which may be carried in the `correlatedNotifications` parameter (see below) of future notifications. Attribute `notificationId` shall be chosen to be unique across all notifications of a particular managed object throughout the time that correlation is significant.

It uniquely identifies this notification from other notifications generated by the subject Managed Object.

If IRPManager receives notifications from one IRPAgent, IRPManager shall use `notificationId` and `managedObjectInstance` to uniquely identify all received notifications.

If IRPManager receives notifications from multiple IRPAgents and notifications of each Managed Object are reported at most through one IRPAgent, IRPManager shall use `notificationId` and `managedObjectInstance` to uniquely identify all received notifications.

If IRPManager receives notifications from multiple IRPAgents and notifications of one or more Managed Objects are reported through two or more IRPAgents, IRPManager shall use `notificationId`, together with `managedObjectInstance` and the identity of IRPAgent, to uniquely identify all received notifications. Attribute `systemDN`, if present, carries IRPAgent's identify. If `systemDN` is absent, IRPManager needs other means, which are outside the scope of this IRP, to determine the identity of IRPAgent.

If and when the value of this can be re-used is specified in SSs.

This attribute is filterable.

6.1.2.2.4 eventTime (M)

It indicates the event occurrence time. The semantics of Generalised Time specified by ITU-T shall be used here.

This attribute is filterable.

6.1.2.2.5 systemDN (C)

It carries the Distinguished Name (DN) of IRPAgent that detects the network event and generates the notification. See [4] for name convention regarding DN.

This attribute is filterable.

6.1.2.2.6 eventType (M)

It carries identification of ITU-T U TMN defined event types. They are:

- Object Creation (ITU-T Recommendation 730)
- Object Deletion (ITU-T Recommendation 730)
- Attribute Value Change (ITU-T Recommendation 731)
- State Change (ITU-T Recommendation 731)
- Relationship Change (ITU-T Recommendation 732)
- Communications Alarm (ITU-T Recommendation 733)
- Processing Error Alarm (ITU-T Recommendation 733)
- Environmental Alarm (ITU-T Recommendation 733)
- Quality of Service Alarm (ITU-T Recommendation 733)
- Equipment Alarm (ITU-T Recommendation 733)
- Integrity Violation (ITU-T Recommendation 736)
- Security Violation (ITU-T Recommendation 736)
- Time Domain Violation (ITU-T Recommendation 736)
- Operational Violation (ITU-T Recommendation 736)
- Physical Violation (ITU-T Recommendation 736)

IRP document, such as Alarm IRP: IS [1] identifies which eventType shall be used for that IRP.

This attribute is filterable.

6.1.2.2.7 extendedEventType (M)

IRPAgent, in certain situations, may generate notifications of types whose semantics are extended beyond those defined by ITU-T event types. Examples are:

- Indicate alarm acknowledgement state changes
- Indicate Alarm List of AlarmIRPAgent has rebuilt successfully.

This attribute carries the required extension.

IRP document, such as Alarm IRP: IS [1] defines the extended event types required.

This attribute is filterable.

6.1.3 Behaviour

6.1.3.1 IRPAgent Supports Multiple Subscriptions with One IRPManager

An IRPManager can have multiple `managerReferences`. IRPManager can invoke `subscribe` operations using different `managerReferences` resulting in multiple subscriptions. As far as IRPAgent is concerned, the IRPAgent is sending alarms to multiple "places".

If IRPManager invokes multiple subscriptions with identical `managerReference` and `notificationCategory` combination, all but one subscription shall fail with exception indicating that the IRPManager is already in subscription.

If IRPManager has established subscription by invoking `subscribe` with `notificationCategory` parameter absent, subsequent `subscribe`, either with `notificationCatgory` absent or present, using the same `managerReference`, shall fail. IRPAgent shall throw exception indicating that the IRPManager is already in subscription.

IRPManager controls the filter constraint via `subscribe` and `changeSubscriptionFilter` operations.

6.1.3.2 Support of packing multiple notifications

It should be possible to pack multiple notifications together for sending to NM. This provides more efficient use of data communication resources. In order to pack multiple notifications, an EM/NE configurable parameter defines the maximum number of notifications to be packed together. Additionally an EM/NE configurable parameter defines the maximum time delay before the notifications have to be sent.

6.1.3.3 IRPAgent Supports Emission of Multiple Notification Categories

IRPAgent supporting this IRP may emit multiple categories of notifications. For example, it may emit notification defined in Alarm IRP [1]. IRPAgent supports mechanism that IRPManager can use to determine the categories of notifications supported by IRPAgent. IRPAgent also supports mechanism that IRPManager can use to specify the categories of notifications IRPAgent should emit to IRPManager during subscription.

6.1.3.4 Subscription list loss

IRPAgent can lose the list of `managerReference` that identifies current IRPManagers under subscription. Under this condition, IRPAgent is incapable of sending events to the affected subscriber(s).

This Notification IRP recommends that IRPManager should invoke the `getSubscriptionStatus` operation periodically to confirm that IRPAgent still has the IRPManager's reference in its list. In case IRPManager does not obtain a positive confirmation, IRPManager should assume that IRPAgent has lost the IRPManager's reference. In this case, IRPManager should invoke `unsubscribe` and then `subscribe` operation again.

This IRP does not recommend the frequency IRPManager should use to invoke `getSubscriptionStatus` operation.

Annex A (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
Post S5#10S_04	3.0.03.0.0	-001	- S5-000227SP-99308	3.0.13.1.0	Updated by MCC staff with editorial changes according to documentation rules.Mechanism for data integrity of signalling messages
S_S5#11S_04	3.0.13.0.0	-002	?SP-99308	3.0.1a3.1.0	Updated according to S5#10bis (S5-000192) and S5#11 (decision to create separate parts for main body and earlier annexes). To be agreed at S5#11bis and approved at S5 #12, together with possible new updates according to S5#11bis.Description of layer on which ciphering takes place

SA5 internal Change history				
SA/SA5 meeting	**Version**	**Tdoc SA/SA5**	**New version**	**Subject/comment**
Post S5#11bis	3.0.1a	S5C000046	3.0.1b	Updated according to agreements at meeting #11bis (including 32.106 split into 8 parts).
Post S5#12	3.0.1b	S5C000063	3.0.1c	Updated according to agreements at meeting #12
Post S5#12	3.0.1c	S5C000069	3.0.1d	Updated according to email discussion after meeting #12