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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
Telecommunication management;
Integration Reference Point (IRP) Information Service (IS)
Unified Modelling Language (UML) repertoire
(3GPP TS 32.152 version 7.1.0 Release 7)**



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Foreword

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- x the first digit:
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

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

TS 32.150:	Integration Reference Point (IRP) Concept and definitions
TS 32.151:	Integration Reference Point (IRP) Information Service (IS) template
TS 32.152:	Integration Reference Point (IRP) Information Service (IS) Unified Modelling Language (UML) repertoire
TS 32.153	Integration Reference Point (IRP) technology specific templates
TS 32.154	Backward and Forward Compatibility (BFC); Concept and definitions

1 Scope

3GPP SA5 has chosen UML to capture systems behaviour in the IRP IS context.

UML provides a rich set of concepts, notations and model elements to model distributive systems. Usage of all UML notations and model elements is not necessary for the purpose of IRP IS specifications. This TS documents the necessary and sufficient set of UML notations and model elements, including the ones built by the UML extension mechanism <<stereotype>>, for use by 3GPP IRP IS authors. Collectively, this set of notations and model elements is called the 3GPP IRP IS modelling repertoire.

The selection of the UML notations and model elements in this repertoire is based on the needs of the existing 3GPP IRP IS specifications. Future IRP IS releases may require the use of additional UML notations or model elements.

IRP IS specifications shall employ the UML notation and model elements of this repertoire and may also employ other UML notation and model elements considered necessary. However, before any other UML notation and model elements may be employed in an approved 3GPP IRP specification, the other notation and model elements should be agreed for inclusion first in this repertoire.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".
- [2] 3GPP TS 32.102: "Telecommunication management; Architecture".
- [3] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".
- [4] 3GPP TS 32.151: "Telecommunication management; Integration Reference Point (IRP) Information Service (IS) template".
- [5] OMG: "Unified Modelling Language Specification, Version 1.5".
<http://www.omg.org/technology/documents/formal/uml.htm>

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.150 [3] and the following apply:

IRPAgent: See 3GPP TS 32.150 [3].

IRPManager: See 3GPP TS 32.150 [3].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.150 [3] and the following apply:

GERAN	GSM/EDGE Radio Access Network
IRP	Integration Reference Point
IS	Information Service
NRM	Network Resource Model
OMG	Object Management Group
UML	Unified Modelling Language (OMG)

4 Requirements

IRPAgent can be characterized by several different but related models. The models can be exterior or interior to the IRPAgent. Exterior models are use case models and interior models are object models.

Current version of this TS focuses on the interior model aspects of IRPAgents.

The notation elements captured in this repertoire shall be used to model all aspects of NRM IRP IS (such as GERAN NRM IRP: IS) and (interface) IRP (such as Alarm IRP: IS).

All quotes are from [5].

Capitalized words are defined by various 3GPP IRP IS specifications or the reference [5].

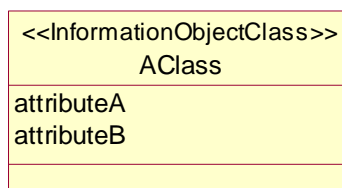
5 Model Elements and Notations

5.1 Basic model elements

UML defined a number of basic model elements. This subclause lists the selected subset for use in the repertoire. The semantics of the selected ones are defined in [5].

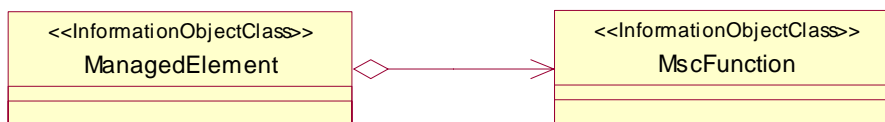
- attribute (subclause 3.25 of [5]).

This sample shows two attributes, listed as strings in the attribute compartment of the class `AClass`.



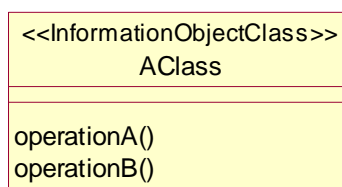
- aggregation (subclause 3.43.2.5 of [5]).

This sample shows a hollow diamond attached to the end of a path to indicate aggregation. The diamond is attached to the class that is the aggregate.



- operation (subclause 3.26 of [5]).

This sample shows two operations, shown as strings in the operation compartment of class `AClass`, that the instance of `AClass` may be requested to perform. The operation has a name, e.g. `operationA` and a list of arguments (not shown).



- association, association name (subclause 3.41 of [5]).

This sample shows a binary association between exactly two model elements. The association can include the possibility relating a model element to itself. This sample shows a bi-directional association in that one model element is aware of the other. Association can be unidirectional (shown with an open arrow at one association end) in that only the source model element is aware of the target model element and not vice-versa.



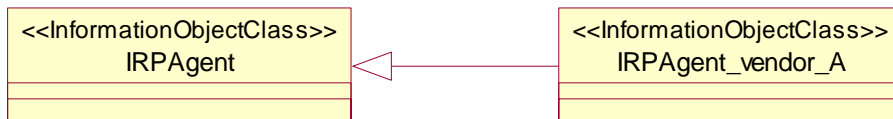
- realization relationship (subclause 2.5.2.1 of [5]).

This sample shows the realization relationship between a `AlarmIRPNotification_1` (the supplier) and a model element, `IRPManager`, that implements it.



- generalization relationship (subclause 3.50 of [5]).

This sample shows a generalization relationship between a more general element (the IRPAgent) and a more specific element (the IRPAgent_vendor_A) that is fully consistent with the first element and that adds additional information.



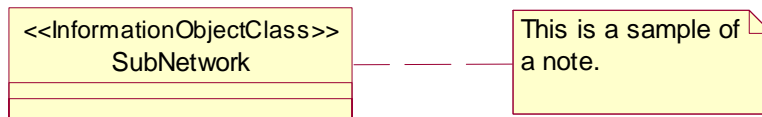
- dependency relationship (subclause 3.51 of [5]).

This sample shows that BClass instances have a semantic relationship with AClass instances. It indicates a situation in which a change to the target element will require a change to the source element in the dependency.



- note (subclause 3.11 of [5]).

This sample shows a note, as a rectangle with a "bent corner" in the upper right corner. The note contains arbitrary text. It appears on a particular diagram and may be attached to zero or more modelling elements by dashed lines.



- Multiplicity, a.k.a. cardinality (subclause 3.44 of [5]).

This sample shows a multiplicity attached to the end of an association path. The meaning of this multiplicity is that one Network instance is associated with zero, one or more SubNetwork instances.



- rolename (subclause 3.43.2.6 of [5]).

This sample shows a Person (say instance John) is associated with a Company (say instance XYZ). We navigate the association by using the opposite association-end such as John.theCompany = "XYZ". Use noun for the rolename.



5.2 Stereotype

This subclause defines all allowable stereotypes that are summarized in the following table. Except <<Interface>>, <<Type>> and <<use>> (which are defined in [5]), all other stereotypes are extensions specifically designed for use in IRP IS specifications.

Table: Stereotypes

Stereotype	Base Class	Affected Metamodel Elements
Interface	Class	
Type	Class	
ProxyClass	Class	
Notification	Class	
Archetype	Classifier (subclause 2.5.2.10 of [5])	
InformationObjectClass	Classifier	
use	Association	
may use	Association	
may realize	Association	
emits	Association	
names	Composition	--
opt (alternatively «optional»)	ModelElement	Attribute, Parameter, and Operation
%	3GPPVisibilityKind	--

5.2.1 <<Interface>>

Subclause 2.5.2.25 of [5]:

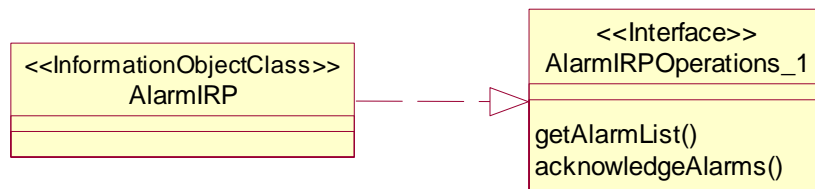
"An interface is a named set of operations that characterize the behaviour of an element. In the metamodel, an Interface contains a set of Operations that together define a service offered by a Classifier realizing the Interface. A Classifier may offer several services, which means that it may realize several Interfaces, and several Classifiers may realize the same Interface.

Interfaces may not have Attributes, Associations, or Methods. An Interface may participate in an Association provided the Interface cannot see the Association; that is, a Classifier (other than an Interface) may have an Association to an Interface that is navigable from the Classifier but not from the Interface."

Subclause 2.5.4.6 of [5]: "The purpose of an interface is to collect a set of operations that constitute a coherent service offered by classifiers. Interfaces provided a way to partition and characterize groups of operations. An interface is only a collection of operations with a name. It cannot be directly instantiated. Insatiable classifiers, such as class or use case, may use interfaces for specifying different services offered by their instances. Several classifiers may realize the same interface. All of them must contain at least the operations matching those contained in the interface. The specification of an operation contains the signature of the operation (i.e. its name, the types of the parameters and the return type). An interface does not imply any internal structure of the realizing classifier. For example, it does not include which algorithm to use for realizing an operation. An operation may, however, include a specification of the effects [e.g. with pre and post-conditions] of its invocation."

5.2.1.1 Sample

This sample shows an AlarmIRPOperations_1 <<Interface>> that has two operations. The operation visibility is public (see definition of public visibility applicable to operation in subclause "visibility"). The input and output parameters of the operations are hidden (i.e. not shown). The AlarmIRP has a unidirectional mandatory realization relationship with the <<Interface>>.



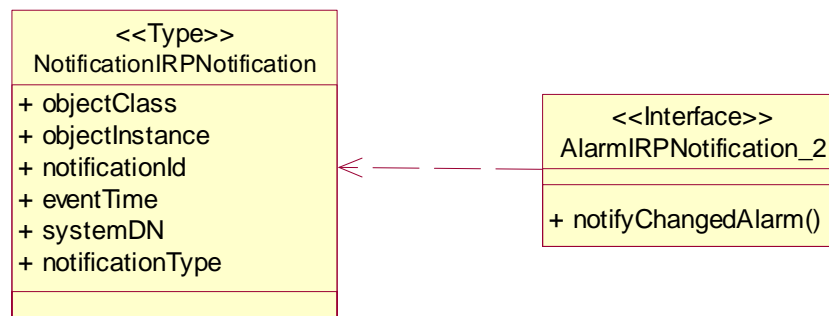
<<Interface>> Notation

5.2.2 <<Type>>

Subclause 3.28 of [5]: "[A Type is] a domain of objects together with the operations applicable to the objects, without defining the physical implementation of those objects. A Type may not contain any methods, maintain its own thread of control, or be nested. However, it may have Attributes and Associations. The Associations of a Type are defined solely for the purpose of specifying the behaviour of the Type's operations and do not represent the implementation of state data".

5.2.2.1 Sample

This sample shows the NotificationIRPNotification <<Type>> that specifies the five parameters (the notification header of Notification IRP). The AlarmIRPNotification_2 <<Interface>> depends (see the dependency relationship, a dashed open arrow line) on this <<Type>> for the construction of the notification emitted via the operation notifyChangedAlarm(). The visibility of attributes and operation in the example is public.



<<Type>> Notation

5.2.3 <<ProxyClass>>

It is a form or template representing a number of <<InformationObjectClass>>. It encapsulates attributes, links, methods (or operations), and interactions that are present in the represented <<InformationObjectClass>>.

The semantics of a <<ProxyClass>> is that all behaviour of the <<ProxyClass>> are present in the represented <<InformationObjectClass>>. Since this class is simply a representation of other classes, this class cannot define its own behaviour other than those already defined by the represented <<InformationObjectClass>>.

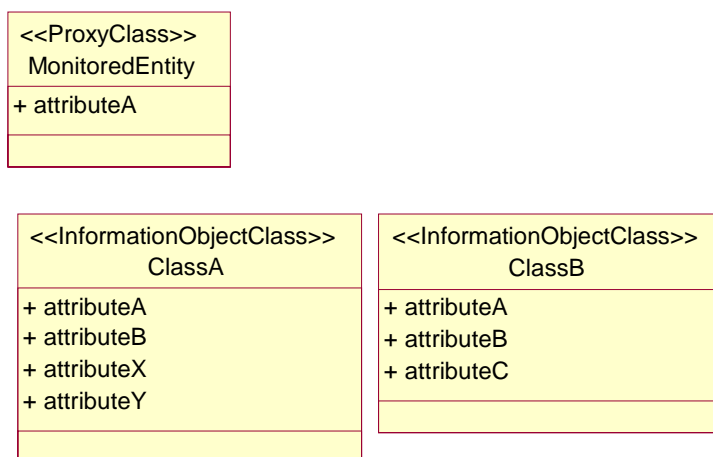
A particular <<InformationObjectClass>> can be represented by zero, one or more <<ProxyClass>> or <<Archetype>>. For example, the ManagedElement <<InformationObjectClass>> can have MonitoredEntity <<ProxyClass>> and ManagedEntity <<ProxyClass>>.

The attributes of the <<ProxyClass>> are accessible by the source entity that has an association with the <<ProxyClass>>.

5.2.3.1 Sample

This shows a <<ProxyClass>> named MonitoredEntity. It represents all NRM <<InformationObjectClass>> (e.g. GgsnFunction <<InformationObjectClass>>) whose instances are being monitored for alarm conditions.

Note that <<MonitoredEntity>> does not define attributeA. The attributeA is already defined by all <<InformationObjectClass>> represented by the <<MonitoredEntity>>, i.e. ClassA and ClassB.



<<ProxyClass>> Notation Sample 1

See Annex A for more samples that use <<ProxyClass>>.

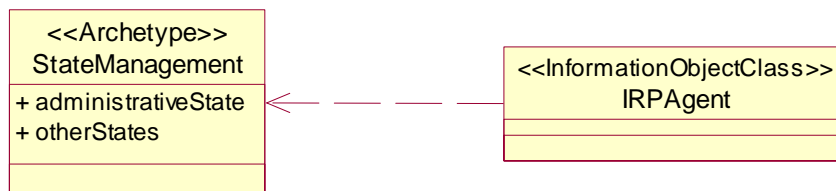
5.2.4 <<Archetype>>

It is a form or template representing a number of <<InformationObjectClass>>. It encapsulates attributes, links, operations, and interactions that are typical of the represented <<InformationObjectClass>>.

The semantics of an <<Archetype>> is that all attributes, links operations and interactions encapsulated by the <<Archetype>> may or may not be present in the represented <<InformationObjectClass>>. The <<Archetype>> represents a placeholder class that is most useful in technology neutral analysis models that will require further specification and/or mapping within a more complete construction model.

5.2.4.1 Sample

This shows a <<Archetype>> named StateManagement. It also shows a <<InformationObjectClass>> IRPAgent that depends on this StateManagement. Note that the StateManagement has defined a number of attributes, the classes that depend on this StateManagement may or may not use all of the StateManagement attributes. In other words, at least one of the attributes of StateManagement is present in the IRPAgent. The precise set of StateManagement attributes used by the IRPAgent is specified in the IRPAgent specification.



<<Archetype>> Notation

5.2.5 <<InformationObjectClass>>

It is the descriptor for a set of network resources and network management capabilities. Each <<InformationObjectClass>> represents a set of instances with similar structure, behaviour and relationships.

This <<InformationObjectClass>> and other information classes such as <<Interface>> are mapped into technology specific model elements. The mapping of IS modelling constructs to technology specific modelling constructs are captured in the corresponding IRP Solution Set specifications.

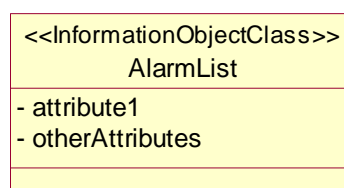
The name of a <<InformationObjectClass>> has scope within the 3GPP IRP IS document in which it is specified and the name must be unique among all <<InformationObjectClass>> names within that 3GPP IRP IS document. The IRP IS document name is considered in the similar way as the UML Package-name.

The <<InformationObjectClass>> is identical to UML *class* except that it does not include/define methods or operations.

Subclause 3.22.1 of [5]: "A *class* represents a concept within the system being modelled. Classes have data structure and behaviour and relationships to other elements."

5.2.5.1 Sample

This sample shows an AlarmList <<InformationObjectClass>>.



<<InformationObjectClass>> Notation

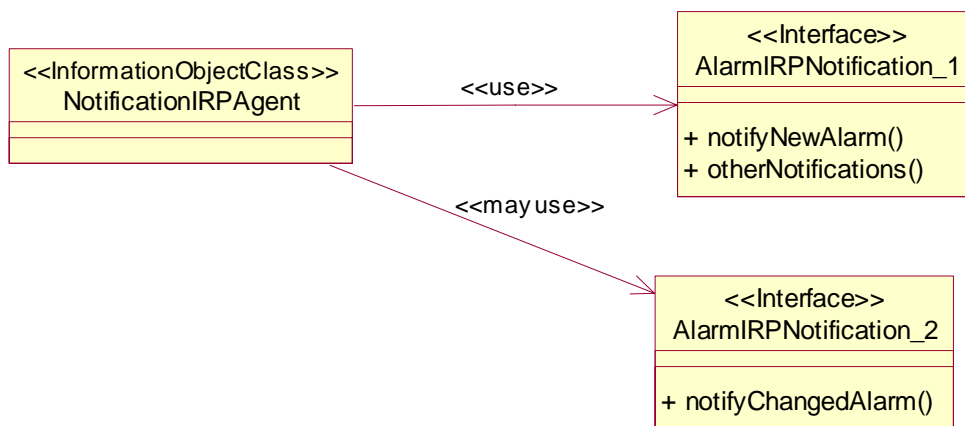
5.2.6 <<use>> and <<may use>>

The <<use>> and <<may use>> are unidirectional associations. The target must be an <<Interface>>. The <<use>> states that the source class must have the capability to use the target <<Interface>> in that it can invoke the operations defined by the <<Interface>>. Support of the capability by the source entity is mandatory. The <<may use>> states that the source class may have the capability to use the target <<Interface>> in that it may invoke the operations defined by the <<Interface>>. Support of the capability by the source entity is optional.

The operations defined by the <<Interface>> are visible across the Iff-N.

5.2.6.1 Sample

This shows that the NotificationIRPAgent shall use the notifyNewAlarm and notifyChangedAlarm of AlarmIRPNotification_1 and may use the notifyChangedAlarm of AlarmIRPNotification_2.



<<use>> and <<may use>> Notation

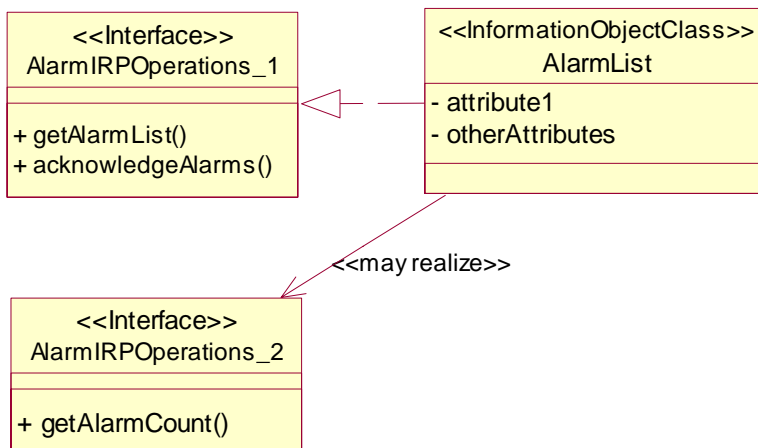
5.2.7 Relationship realize and <<may realize>>

The relationship realize and <<may realize>> are unidirectional association. The target must be an <<Interface>>. The relationship "realize" shows that the source entity must realize the operations defined by the target <<Interface>>. Realization of operations by the source entity is mandatory. The <<may realize>> shows the source entity may realize the operations defined by the target <<Interface>>. Realization of the <<Interface>> by the source entity is optional.

The operations defined by <<Interface>> are visible across the Itf-N.

5.2.7.1 Sample

This shows that the AlarmList shall realize (or support, implement) the two operations of AlarmIRPOperations_1 and may realize the operation of AlarmIRPOperations_2.



Relationship realize and <<may realize>> Notations

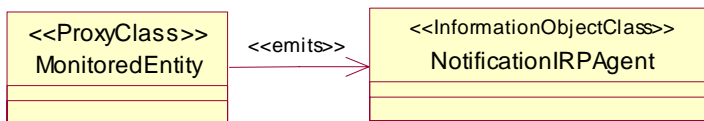
5.2.8 <<emits>>

This is a unidirectional association. The source sends information to target. In the case that the target is NotificationIRPAgent, the information will then carry the semantics of 3GPP notification (e.g. notifyObjectCreation, notifyNewAlarm) such that the target NotificationIRPAgent can construct the relevant 3GPP notification for reception by the IRPManager.

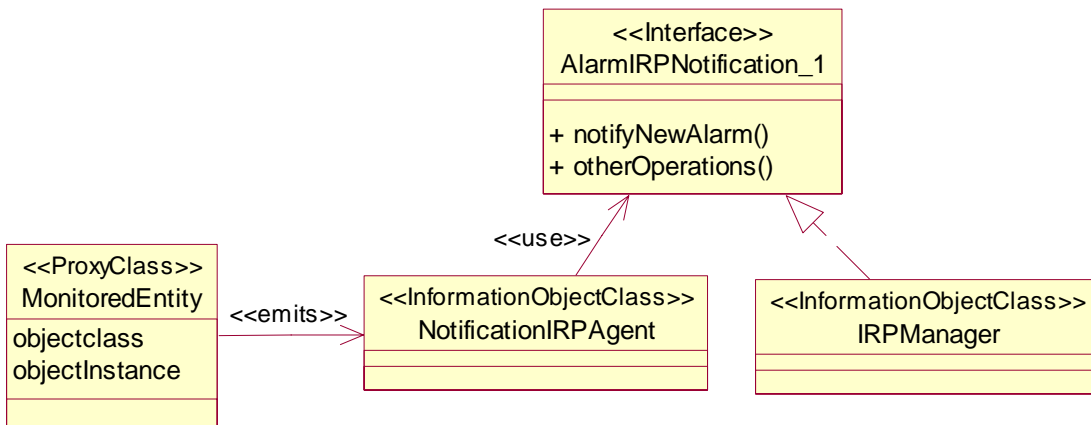
The visibility of the information passed by <<emits>> is always "IRPAgent Internal" (see subclause on "Visibility").

5.2.8.1 Sample

This shows the MonitoredEntity (e.g. a GgsnFunction instance) emits notifications that are received by the NotificationIRPAgent. The emission is not visible across the Itf-N.



<<emits>> Notation



<<use>>, <<emits>> and realize relationship Notation

5.2.9 <<names>>

It specifies a unidirectional composition. The target instance is uniquely identifiable, within the namespace of the source entity, among all other targeted instances of the same target classifier and among other targeted instances of other classifiers that have the same <<names>> composition with the source.

Composition used as the act of name containment provides a semantic of a whole-part relationship between the domain and the named elements that are contained, even if only by name. From the management perspective access to the part is through the whole. Multiplicity shall be indicated on both ends of the relationship.

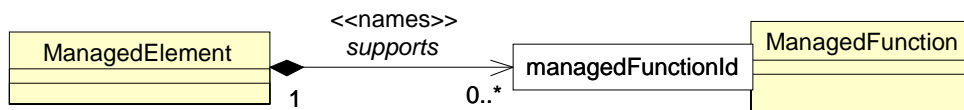
A target can not have multiple <<names>> with multiple sources, i.e. a target can not participate in or belong to multiple namespaces.

By convention, the name of the attribute in the target model element to hold part of the unique identification shall be formed by the name of the target class concatenated with "Id". There are two presentation options for the unique identification attribute of the class being named.

- 1) The use of the role qualifier allow the unique identification attribute to be attached to the target end of the <<names>> association (see the following figure).
- 2) The unique identification attribute may be indicated as a normal attribute within the class attribute compartment.

5.2.9.1 Sample

This shows that all instances of ManagedFunction are uniquely identifiable within the ManagedElement namespace. Note the use of the label supports in specifications is optional.

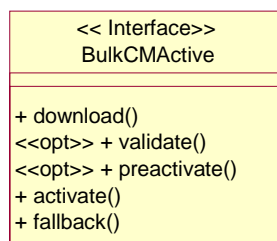


<<names>> Notation, Composition and explicit Qualifier

5.2.10 <<opt>>

The <<opt>> (alternatively <<optional>>) enables the indication of optionality of attributes, parameters and operations (respectively) within the UML diagrams. The semantics of optionality are clearly defined in TS 32.150 [3].

In the absence of the stereotype, the attribute, parameter, or operation in question is mandatory.



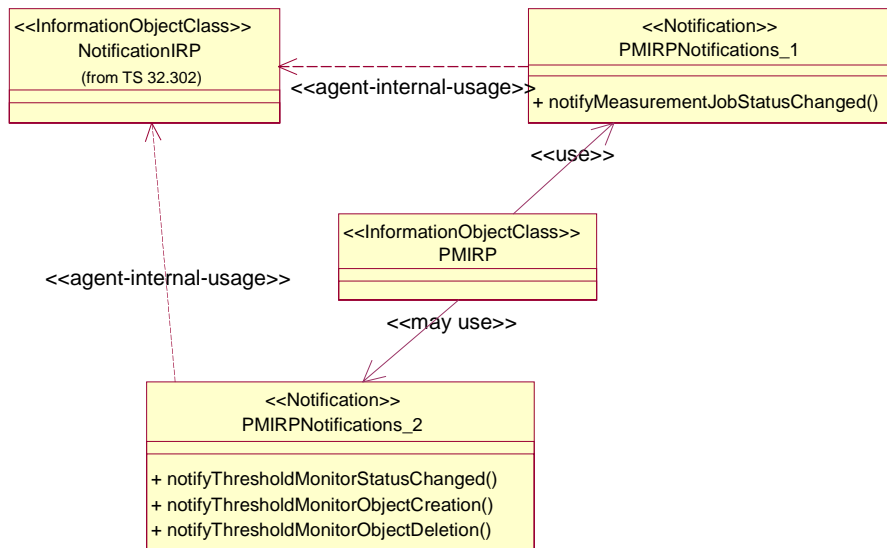
Example of the use of optionality indicator for operations

5.2.11 <<Notification>>

<<Notification>> is a named set of notifications. In the metamodel, a <<Notification>> contains a set of Notifications that together define a service offered by a Classifier realizing the <<Notification>>.

5.2.11.1 Sample

This sample shows a <<Notification>> named “PMIRPNotifications_1” that has one notification and a <<Notification>> named “PMIRPNotifications_2” that has three notifications.



5.3 Visibility

It specifies the accessibility of the operation and attribute. There are three types of visibility, i.e. private, public and IRPAgent Internal.

Private Visibility (notation "-")

Operation	NA
Attribute	It indicates that the attribute is not accessible by other entities, e.g. the IRPManager, other entities not holding the subject attribute

Public Visibility (notation "+")(default)

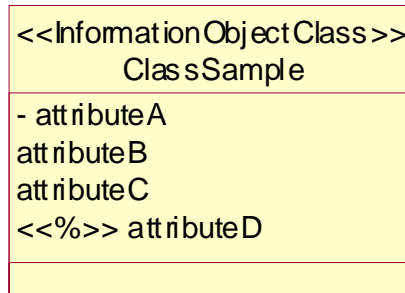
Operation	It indicates that the operation is visible across the Itf-N, e.g. the IRPManager can invoke the operation across the Itf-N interface.
Attribute	it indicates that the attribute is accessible across the Itf-N, i.e. the IRPManager can invoke an operation to read the attribute and to write to this attribute if the attribute is so qualified. The read or write operation must be directly invoked against the entity holding the subject attribute or against the IRPAgent.

IRPAgent Internal Visibility (notation "%")

Operation	It indicates that the operation is not visible across the Itf-N, i.e. the IRPManager cannot invoke the operation. However, other entities can invoke the operation (see note).
Attribute	It indicates that the attribute is not directly accessible across the Itf-N, i.e. the IRPManager cannot read/write this attribute. However, other entities can read/write this attribute.

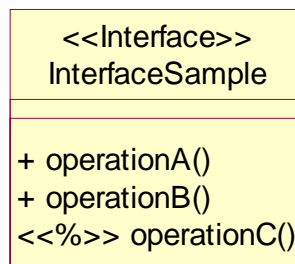
5.3.1 Samples

This sample shows four attributes whose visibility are private, public (default notation), public and IRP Agent Internal. It is recommended that within a Class symbol, the use of default notation or not for public visibility should be consistent, i.e. all "publicly visible" attributes shall be shown with the "+" sign or without the "+" sign (default notation).



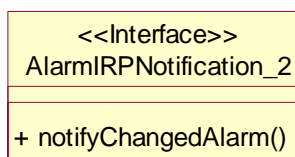
Visibility of attributes

This sample shows three operations. Two of these operations are accessible by the IRPManager via the Itf-N. It is recommended that within a Class symbol, the use of default notation or not for public visibility should be consistent, i.e. all "publicly visible" operation shall be shown with the "+" sign or without the "+" sign (default notation).



Visibility of operations

This sample shows one notification whose visibility is public using the non-default public visibility notation. These notifications are accessible by the IRPManager via the Itf-N.



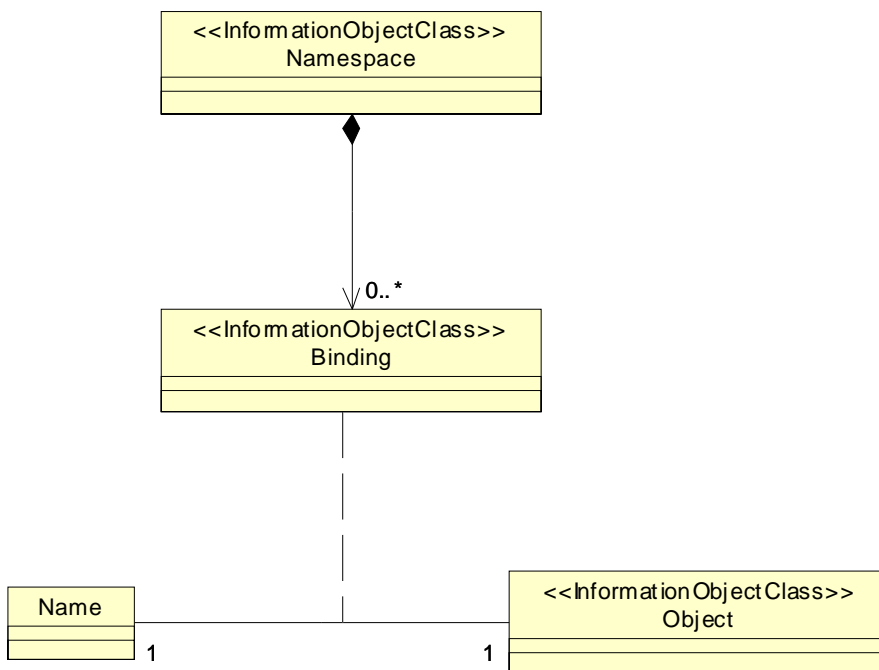
Visibility of notification

5.4 Association classes

Subclause 3.46 of OMG: "Unified Modelling Language Specification, Version 1.51" [5] <http://www.omg.org/technology/documents/formal/uml.html> defines an association class as

"An association class is an association that also has class properties (or a class that has association properties). Even though it is drawn as an association and a class, it is really just a single model element."

Association classes are appropriate for use when an «InformationObjectClass» needs to maintain associations to several other «InformationObjectClass»'s and there are relationships between the members of the associations within the scope of the "containing" «InformationObjectClass». For example, a namespace maintains a set of bindings, a binding ties a name to an object. A Binding «IOC» can be modeled as an Association Class that provides the binding semantics to the relationship between a name and some other «InformationObjectClass». This is depicted in the following figure (exemplary only, not taken from another 3GPP specification).



Example of an Association Class

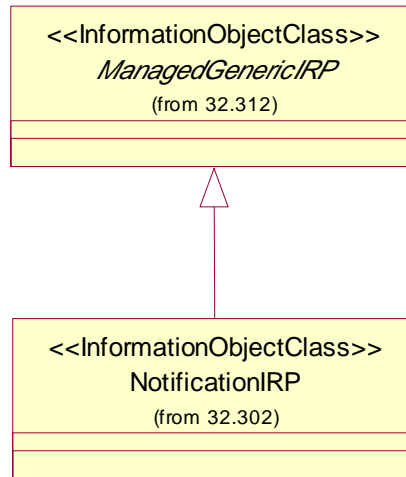
5.5 Abstract Class

It specifies a <<InformationObjectClass>> as a base class to be inherited by subclasses. An abstract class can not be.

Abstract class notation is the use of italics in the class name of the corresponding <<InformationObjectClass>> in the diagram.

5.5.1 Sample

This shows that ManagedGenericIRP is an abstract <<InformationObjectClass>>.



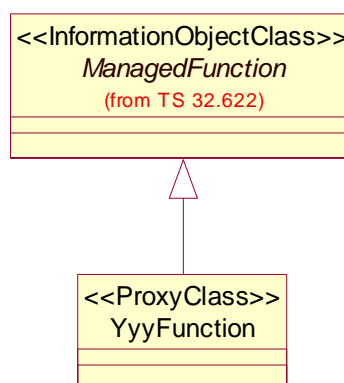
Abstract Class Notation

Annex A (informative): Samples of using <<ProxyClass>> to model Link related IOCs

A.1 First Sample

This shows a <<ProxyClass>> named YyyFunction. It represents all IOCs listed in the Note under the UML diagram. All the listed IOCs, in the context of this sample, inherit from ManagedFunction IOC.

The use of <<ProxyClass>> eliminates the need to draw multiple UML <<InformationObjectClass>> boxes, i.e. those whose names are listed in the Note, in the UML diagram.



Note: The YyyFunction <<ProxyClass>> represents AsFunction, AucFunction, BgFunction, ...

<<ProxyClass>> Notation Sample A.1

A.2 Second Sample

This shows a <<ProxyClass>> named YyyFunction. It represents all IOCs listed in the Note right under the UML diagram. All the listed IOCs, in the context of this sample, have link (internal and external) relations.

The actual names of the IOC represented by InternalYyyFunction <<ProxyClass>> and by the ExternalYyyFunction <<ProxyClass>> are listed under the subsection of X.Y of the associated YyyFunction. For example, under X.Y.1 for AsFunction, two paragraphs are added to list all peer internal entities and external entities that are linked with AsFunction. See sample in quotation below that is using AsFunction as a sample for YyyFunction.

The actual names of the IOC represented by Link_a_z <<ProxyClass>> and by ExternalLink_a_z <<ProxyClass>> are listed under the subsection of X.Y of the associated YyyFunction. For example, under X.Y.1 for AsFunction, two paragraphs are added to list the names of the IOCs represented by Link_a_z and by ExternalLink_a_z. See the quoted text below that is using AsFunction as a sample for YyyFunction.

“

X.Y.1 AsFunction

X.Y.1.1 Definition

This IOC represents As functionality. For more information about the As, see 3GPP TS 23.002 [15].

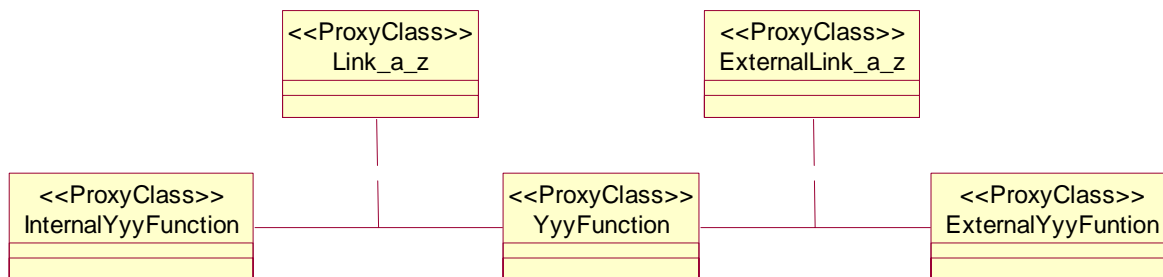
The linked InternalYyyFunction <<ProxyClass>> represents SlsFunction, CscfFunction, HlrFunction ...

The linked ExternalYyyFunction <<ProxyClass>> represents ...

The Link_a_z <<ProxyClass>> represents Link_As_Scscf, Link_Bgcf_Scscf ...

The ExternalLink_a_z <<ProxyClass>> represents ...

“



NOTE: The 'Yyy' of YyyFunction <<ProxyClass>> represents AsFunction, AucFunction, ...

<<ProxyClass>> Notation Sample A.2

Annex B (informative): Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Cat	Old	New
Dec 2003	SA_22	SP-030615	--	--	Submitted to TSG SA#22 for Information	--	1.0.0	
Mar 2004	SA_23	SP-040115	--	--	Submitted to TSG SA#23 for Approval	--	2.0.0	6.0.0
Oct 2006	--	--	--	--	Corrected TS ver. and Rel #; added GSM logo in line with 41.101	--	6.0.0	6.0.1
Jun 2004	SA_24	SP-040242	0001	--	UML Repertoire Updates (Associations)	C	6.0.1	6.1.0
Mar 2005	SA_27	SP-050023	0002	--	Add "abstract" adornment	F	6.1.0	6.2.0
Jun 2005	SA_28	SP-050284	0003	--	Add the stereotype "Notification" to UML repertoire. Align with TS 32.412	F	6.2.0	6.3.0
Jun 2005	SA_28	SP-050284	0004	--	Correction of stereotype name capitalization and visibility qualifiers	F	6.2.0	6.3.0
Dec 2005	SA_30	SP-050729	0005	--	Apply IS template - Align with 32.151	F	6.3.0	7.0.0
Mar 2007	SA_35	SP-070045	0006	--	Add samples to illustrate the use of ProxyClass to model Link related objects	F	7.0.1	7.1.0
Mar 2007	SA_35	SP-070045	0007	--	Correct the references of IRPAgent and IRPManager	F	7.0.1	7.1.0
Mar 2007	--	--	--	--	Deleted reference to CMIP SS, discontinued from R7 onwards	--	7.0.1	7.1.0

History

Document history		
V7.0.1	September 2006	Publication
V7.1.0	March 2007	Publication