Technical Specification Group Services and System Aspects
Meeting #17, Biarritz, France, 9-12 September 2002

TSGS#17(02)0450

Source: **SA5 (Telecom Management)**

Title: **Rel-5 CRs 32.102 (3G Telecom Management Architecture)**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc-1st-	Spec	CR	Rev	Phase	Subject	Cat	Version-	Doc-2nd-	Workitem
SP-020450	32.102	020	-	Rel-5	**Correction of diagrams describing entities of the mobile system to be managed**	F	5.0.0	S5-022235	OAM-AR
SP-020450	32.102	021	-	Rel-5	**IS Template Changes to support new UML Repertoire/Methodology**	F	5.0.0	S5-026738	OAM-AR
SP-020450	32.102	022	-	Rel-5	**Addition of 3GPP UML Repertoire for IRP: IS**	F	5.0.0	S5-026750	OAM-AR

3GPP TSG-SA5 (Telecom Management) **S5-022235**
Meeting #30, Tampere, FINLAND, 19 - 23 August 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.102** **CR** **020** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Correction of diagrams describing entities of the mobile system to be managed
Source:	⌘	SA5
Work item code:	⌘	OAM-AR
Date:	⌘	23/08/2002
Category:	⌘	**F**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	Erroneous inclusion of IMS in TS32.102 v5.0.0
Summary of change:	⌘	Correction of diagrams describing entities of the mobile system
Consequences if not approved:	⌘	The description of the specific entities of the mobile system would not be in alinement with 3G Network architecture

Clauses affected:	⌘			
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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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] ITU-T Recommendation M.3010 (2000): "Principles for a telecommunications management network".

[2] 3GPP TS 32.101: "3G Telecom Management principles and high level requirements".

[3] Void

[4] ITU-T Recommendation X.200 (1994): "Information technology – Open Systems Interconnection – Basic reference model: The basic model".

[5] Void

[6] Void

[7] Void

[8] Void

[9] TMF GB910. Smart TMN Telecom Operations Map (Release 1.1).

[10] TMF GB909. Smart TMN Technology Integration Map (Issue 1.1).

[11] ITU-T Recommendation M.3013 (2000): “Considerations for a telecommunications management network”.

[12] 3GPP TS 23.002: "Network architecture (Release 54)".

[13] 3GPP TS 23.101: "General UMTS Architecture (Release 4)".

[14] 3GPP TS 32.111: "3G Fault Management".

3.1 Definitions

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

Architecture: The organisational structure of a system or component, their relationships, and the principles and guidelines governing their design and evolution over time.

Closed interfaces: Privately controlled system/subsystem boundary descriptions that are not disclosed to the public or are unique to a single supplier.

De facto standard: A standard that is widely accepted and used but that lacks formal approval by a recognised standards organisation.

Information Object : defined in 3GPP TS 32.101 [2].

Information Service: defined in 3GPP TS 32.101 [2].

Interface standard: A standard that specifies the physical or functional interface characteristics of systems, subsystems, equipment, assemblies, components, items or parts to permit interchangeability, interconnection, interoperability, compatibility, or communications.

Interoperability: The ability of two or more systems or components to exchange data and use information.

Intra-operability: The ability to interchange and use information, functions and services among components within a system.

IRPAgent: The IRPAgent encapsulates a well-defined subset of network (element) functions. It interacts with IRPManagers using an IRP. From the IRPManager's perspective, the IRPAgent behaviour is only visible via the IRP.

IRPManager: The IRPManager models a user of the IRPAgent and it interacts directly with the IRPAgent using the IRP. From the IRPAgent perspective, the IRPManager behaviour is only visible via the IRP.

IRP Information Model: defined in 3GPP TS 32.101 [2].

IRP Information Service: defined in 3GPP TS 32.101 [2].

IRP Solution Set: defined in 3GPP TS 32.101 [2].

IRPManager: The IRPManager models a user of the IRPAgent and it interacts directly with the IRPAgent using the IRP. Since the IRPManager represents an IRPAgent user, they help delimit the IRPAgent and give a clear picture of what the IRPAgent is supposed to do. From the IRPAgent perspective, the IRPManager behaviour is only visible via the IRP.

IRP Information Model: An IRP Information Model consists of an IRP Information Service and a Network Resource Model (see below for definitions of IRP Information Service and Network Resource Model).

IRP Information Service: An IRP Information Service describes the information flow and support objects for a certain functional area, e.g. the alarm information service in the Fault Management area. As an example of support objects, for the Alarm IRP there is the "alarm information" and "alarm list".

IRP Solution Set: An IRP Solution Set is a mapping of the IRP Information Service to one of several technologies (CORBA/IDL, SNMP/SMI, CMIP/GDMO etc.). An IRP Information Service can be mapped to several different IRP Solution Sets. Different technology selections may be done for different IRPs.

Managed Object : defined in 3GPP TS 32.101 [2].

Management Infrastructure: The collection of systems (computers and telecommunications) a UMTS Organisation has in order to manage UMTS.

Market Acceptance: Market acceptance means that an item has been accepted in the market as evidenced by annual sales, length of time available for sale, and after-sale support capability.

Modular: Pertaining to the design concept in which interchangeable units are employed to create a functional end product.

Module: An interchangeable item that contains components. In computer programming, a program unit that is discrete and identifiable with respect to compiling, combining with other modules, and loading is called a module.

Network Resource Model (NRM): defined in 3GPP TS 32.101 [2]..

Open Specifications: Public specifications that are maintained by an open, public consensus process to accommodate new technologies over time and that are consistent with international standards.

Open Standards: Widely accepted and supported standards set by recognised standards organisation or the commercial market place. These standards support interoperability, portability, and scalability and are equally available to the general public at no cost or with a moderate license fee.

Open Systems Strategy: An open systems strategy focuses on fielding superior telecom capability more quickly and more affordably by using multiple suppliers and commercially supported practices, products, specifications, and standards, which are selected based on performance, cost, industry acceptance, long term availability and supportability, and upgrade potential.

Physical Architecture: A minimal set of rules governing the arrangement, interaction, and interdependence of the parts or elements whose purpose is to ensure that a conformant system satisfies a specified set of requirements. The physical architecture identifies the services, interfaces, standards, and their relationships. It provides the technical guidelines for implementation of systems upon which engineering specifications are based and common building blocks are built.

Plug&play: Term for easy integration of HW/SW.

Portability: The ease with which a system, component, data, or user can be transferred from one hardware or software environment to another.

Proprietary Specifications: Specifications, which are exclusively owned by a private individual or corporation under a trademark or patent, the use of which would require a license.

Reference Model: A generally accepted abstract representation that allows users to focus on establishing definitions, building common understandings and identifying issues for resolution. For TMN Systems acquisitions, a reference model is necessary to establish a context for understanding how the disparate technologies and standards required to implement TMN relate to each other. A reference model provides a mechanism for identifying the key issues associated with applications portability, modularity, scalability and interoperability. Most importantly, Reference Models will aid in the evaluation and analysis of domain-specific architectures.

Scalability: The capability to adapt hardware or software to accommodate changing workloads.

Service Specific Entities: Entities dedicated to the provisioning of a given (set of) service(s). The fact that they are implemented or not in a given PLMN should have limited impact on all the other entities of the PLMN.

Solution Set: defined in 3GPP TS 32.101 [2].

Specification: A document that prescribes, in a complete, precise, verifiable manner, the requirements, design, behaviour, or characteristics of a system or system component.

Standard: A document that establishes uniform engineering and technical requirements for processes, procedures, practices, and methods. Standards may also establish requirements for selection, application, and design criteria of material.

Standards Based Architecture: An architecture based on an acceptable set of open standards governing the arrangement, interaction, and interdependence of the parts or elements that together may be used to form a TMN System, and whose purpose is to insure that a conformant system satisfies a specified set of requirements.

Support object : defined in 3GPP TS 32.101 [2].

System : Any organised assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions.

System Architecture (SA): A description, including graphics, of systems and interconnections providing for or supporting management functions. The SA defines the physical connection, location, and identification of the key nodes, circuits, networks, platforms, etc., and specifies system and component performance parameters. It is constructed to satisfy Operational Architecture requirements per standards defined in the Physical Architecture. The SA shows how multiple systems within a subject area link and inter-operate, and may describe the internal construction or operations of particular systems within the architecture.

UMTS Organisation: A legal entity that is involved in the provisioning of UMTS.

3.2 Abbreviations

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

3G	3rd Generation
AN	Access Network
AS	Application Server
ATM	Asynchronous Transfer Mode
AUC	Authentication Centre
BG	Border Gateway
BGCF	Breakout Gateway Control Function
BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
CAMEL	Customised Applications for Mobile network Enhanced Logic
CBC	Cell Broadcast Center
CBS	Celll Broadcast Service
CIM	Common Information Model Specification (from DMTF)
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
CN	Core Network
CS	Circuit Switched
CORBA	Common Object Request Broker Architecture
CSCF	Call Session Control Function
DCN	Data Communication Network
DECT	Digital Enhanced Cordless Telecommunications
DSS1	Digital Subscriber System 1
EIR	Equipment Identity Register
E-OS	Element Management Layer-Operations System
F/W	Firewall
FM	Fault Management
FTAM	File Transfer, Access and Management
GCR	Group Call Register
GDMO	Guidelines for the Definition of Managed Objects
GGSN	Gateway GPRS Support Node
GMLC	Gateway Mobile Location Center
GMSC	Gateway MSC
GPRS	General Packet Radio Service
GTT	Global Text Telephony
HLR	Home Location Register
HSS	Home Subscriber Server
HTTP	HyperText Transfer Protocol
HW	Hardware
I-CSCF	Interrogating CSCF
IDL	Interface Definition Language
IIOP	Internet Inter-ORB Protocol
IM	Information Model
IM-MGW	IP Multimedia Media Gateway
IMS	IP Multimedia Subsystem
INAP	Intelligent Network Application Part
IP	Internet Protocol
IRP	Integration Reference Point
IS	Information Service
ISDN	Integrated Services Digital Network
IWU	Inter Working Unit
LCS	Location Services
LMU	Location Measurement Unit
MD	Mediation Device
ME	Mobile Equipment
MGCF	Media Gateway Control Function

MIB	Management Information Base
MMI	Man-Machine Interface
MML	Man-Machine Language
MMS	Multimedia Messaging Service
MNP	Mobile Number Portability
MNP-SRF	Mobile Number Portability/Signalling Relay Function
MRF	Multimedia Resource Function
MRFC	Multimedia Resource Function Controller
MRFP	Multimedia Resource Function Processor
MSC	Mobile service Switching Centre
MT	Mobile Termination
NE	Network Element
N-OS	Network Management Layer-Operations System
NPDB	Number Portability Database
NR	Network Resource
NRM	Network Resource Model
NSS	Network Switching Subsystem
NW	Network
OMG	Object Management Group
OS	Operations System
OSA	Open Services Access
OSF	Operations System Functions
P-CSCF	Proxy CSCF
PDH	Plesiochronous Digital Hierarchy
PS	Packet Switched
PSA	Product Specific Applications
PSS	Packet Switched Service
PSTN	Public Switched Telephone Network
QA	Q-Adapter
QoS	Quality of Service
RNC	Radio Network Controller
RNS	Radio Network System
RSVP	Resource ReserVation Protocol
S-CSCF	Serving CSCF
SDH	Synchronous Digital Hierarchy
SGSN	Serving GPRS Support Node
SGW	Signalling Gateway
SLA	Service Level Agreement
SLF	Subscription Locator Function
SIM	Subscriber Identity Module
SMLC	Serving Mobile Location Center
SMI	Structure of Management Information
SMS	Short Message Service
SNM	Sub-Network Manager
SNMP	Simple Network Management Protocol
SS	Solution Set
SS7	Signalling System No. 7
SW	Software
TA	Terminal Adapter
TE	Terminal Equipment
TM	Telecom Management
TMN	Telecommunications Management Network as defined in ITU-T Recommendation M.3010 [1].
UE	User Equipment
UML	Unified Modelling Language
UMTS	Universal Mobile Telecommunications System
USAT	USIM/SIM Application Toolkit
USIM	UMTS Subscriber Identity Module
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
VHE	Virtual Home Environment
VLR	Visitor Location Register
WBEM	Web Based Enterprise Management
WS	Workstation

7.3.2 Interfaces

A UMTS will consist of many different types of components based on different types of technologies. There will be access-, core-, transmission- and ~~intelligent~~ service node networks and many of the UMTS components have already been the targets for Telecom Management standardisation at different levels. Many of these standards will be reused and the management domain of a UMTS will thereby consist of many TMNs. The architecture of -UMTS TMNs should support distributed TMNs and TMN-interworking on peer-to-peer basis.

The Telecom Management Architecture can vary greatly in scope and detail, because of scale of operation and that different organisations may take different roles in a UMTS (see clause 5). The architecture of UMTS TMNs should provide a high degree of flexibility to meet the various topological conditions as the physical distribution and the number of NEs. Flexibility is also required to allow high degree of centralisation of personnel and the administrative practices as well as allowing dispersion to administrative domains (see further clause 10). The 3G Telecom Management architecture should be such that the NEs will operate in the same way, independently of the OS architecture.

Figure 7.2 illustrates the basic domains in UMTS (identified in 3GPP Technical Standards [12], [13]), related management functional areas and introduces Interface-N (Itf-N).

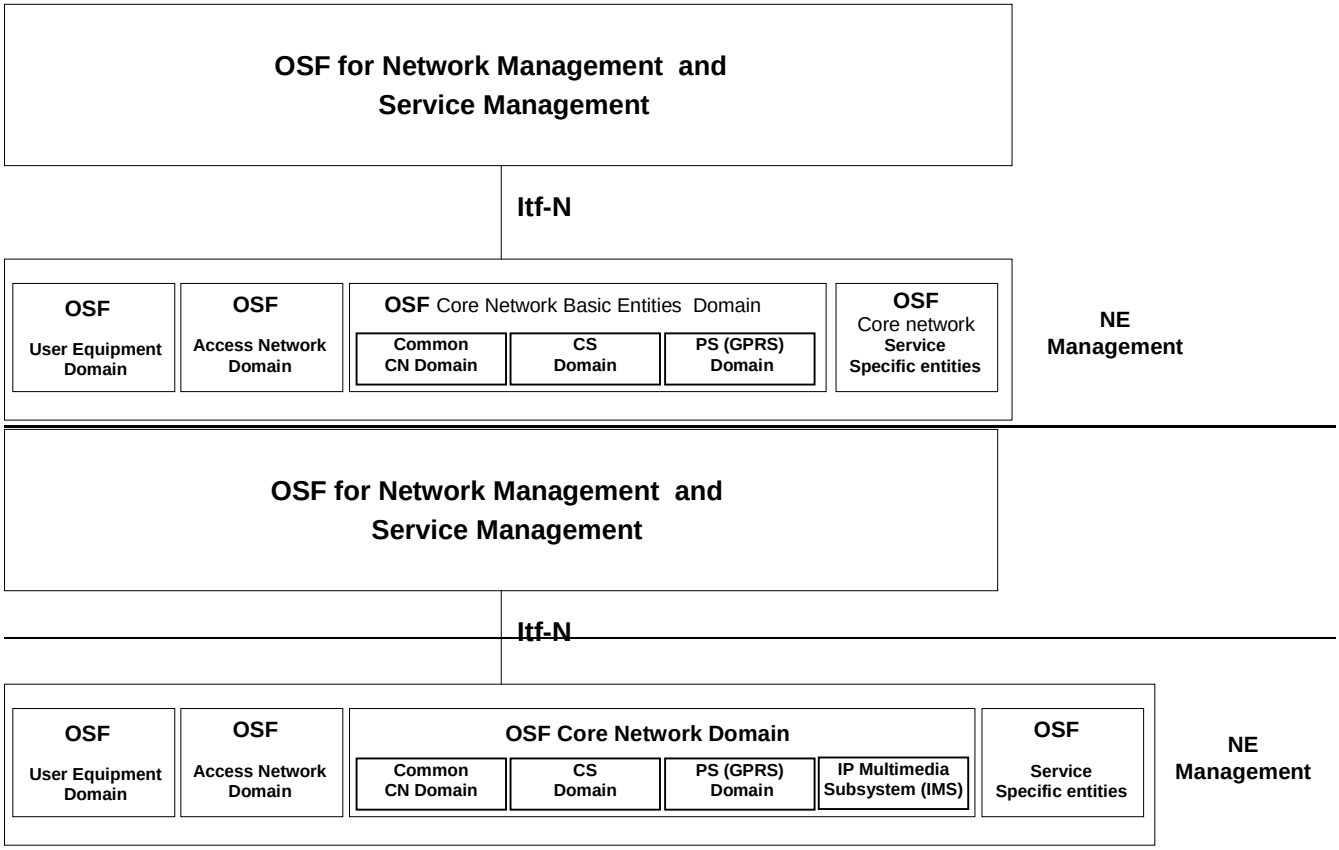


Figure 7.2: Overview of UMTS Telecom Management Domains and Itf-N

Itf-N between the NE OSFs and NM/SM OSFs could be used by the network- and service management systems to transfer management messages, notifications and service management requests via the NE OSF to the Network Elements (NEs).

This interface shall be open and the information models standardised.

Telecom management interfaces may be considered from two perspectives:

1. the management information model;
2. the management information exchange.

The management information models will be standardised in other 3GPP documents but the management information exchange will be further described in this architectural standard.

The management task will vary greatly between different network elements in a UMTS. Some NEs are of high complexity e.g. a RNC, while others e.g. a border gateway is of less complexity. Different application protocols can be chosen to best suite the management requirements of the different Network Elements and the technology used.

Application protocols can be categorised out of many capabilities as:

- Functionality;
- Implementation complexity;
- Processor requirements;
- Cost efficiency;
- Market acceptance, availability of "off the shelf commercial systems and software".

For each Telecom Management interface that will be standardised by 3GPP at least one of the accepted protocols will be recommended. Accepted application protocols (e.g. CMIP, SNMP, CORBA IIOP) are defined in 3GPP TS 32.101 [2], Annex A.

7.3.3 ~~Basic e~~Entities of a UMTS

To provide the mobile service as it is defined in a UMTS, some specific functions are introduced [12]. These functional entities can be implemented in different physical equipments or gathered. In any case, exchanges of data occur between these entities and from the Telecom Management perspective they can all normally be treated as network elements of a UMTS. The basic telecom management functional areas as fault management, configuration management, performance management and security management are all applicable to these UMTS entities. As such they are all the targets for UMTS Telecom Management technical standards.

As discussed in clause 5, there will be many possible ways to build a UMTS and thereby many possible architectures of a mobile system. The entities presented in figure~~s~~ 7.3~~a,b,c,d~~ should be treated as the fundamental building blocks of any possible implementation of a UMTS.

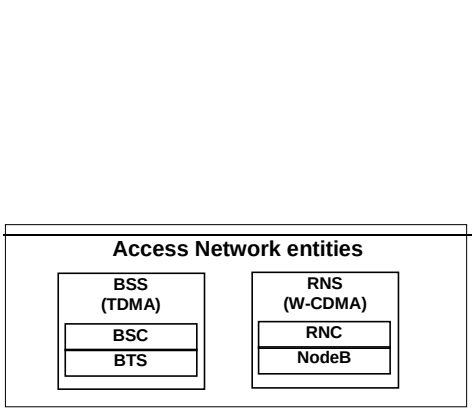


Figure 7.3a: Basic AN entities

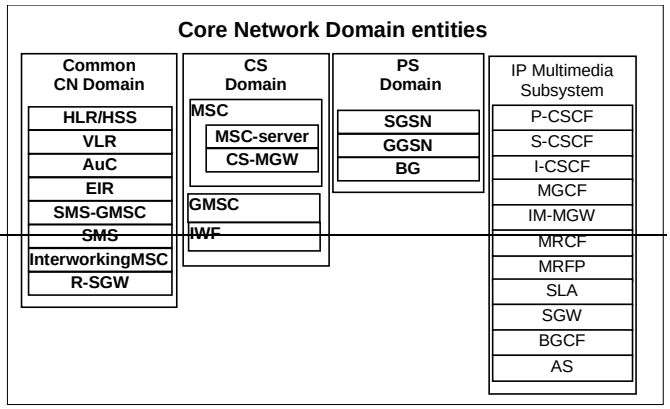


Figure 7.3b: Basic CN entities

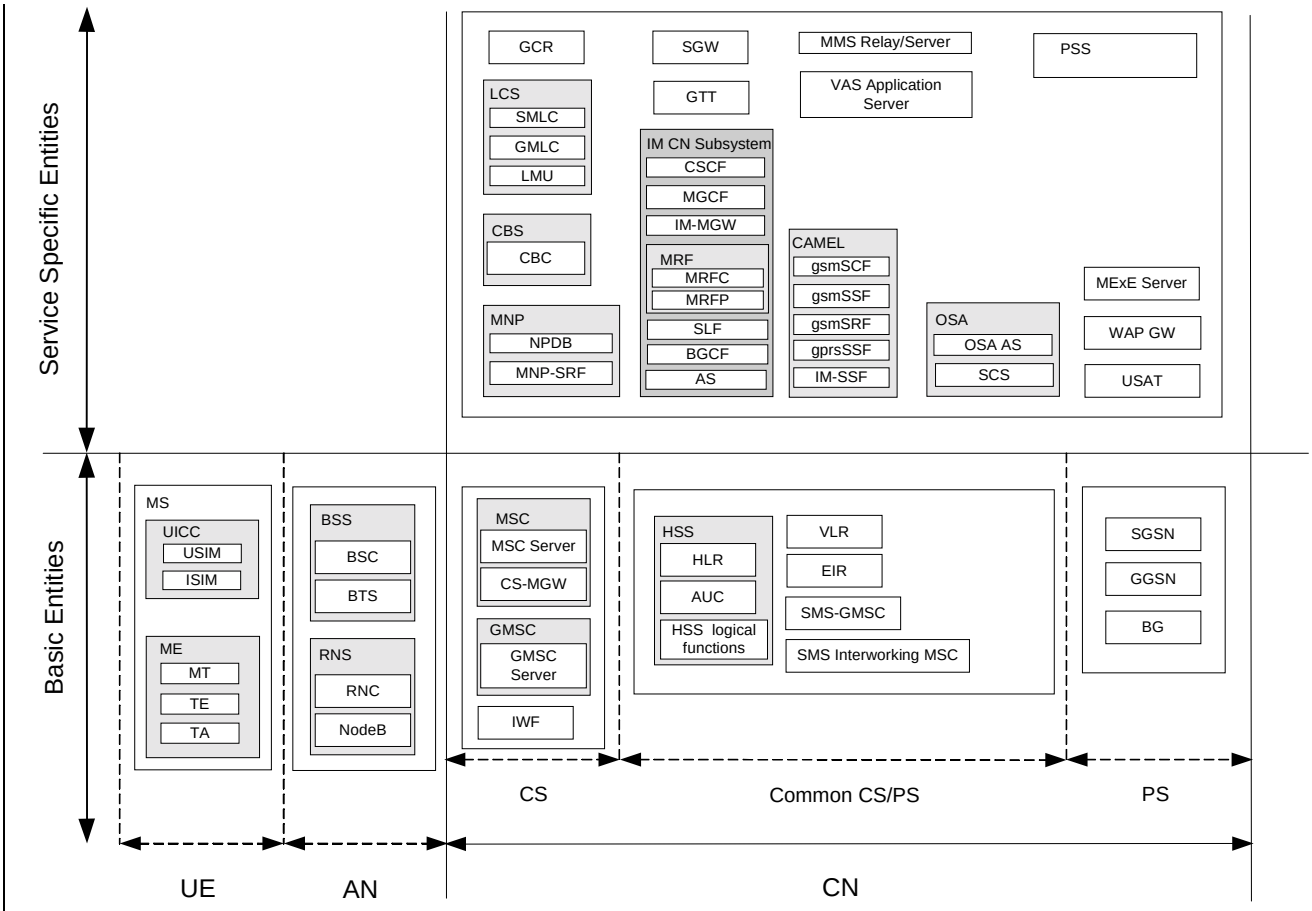
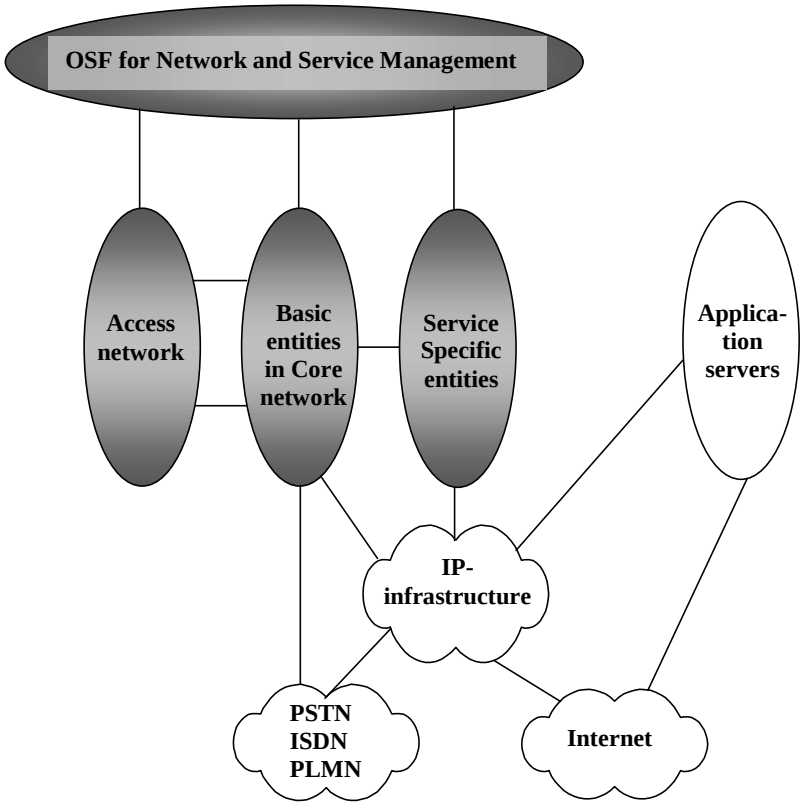


Figure 7.3 Examples of entities of the mobile system to be managed

In figure 7.4 the prime domains for the standardisation effort of 3GPP Telecom Management are shown as shaded.


OSF for Network and Service Management
Access network
Basic entities in Core network
Service Specific entities
Applica-tion servers
IP-infrastructure
PSTN
ISDN
PLMN
Internet

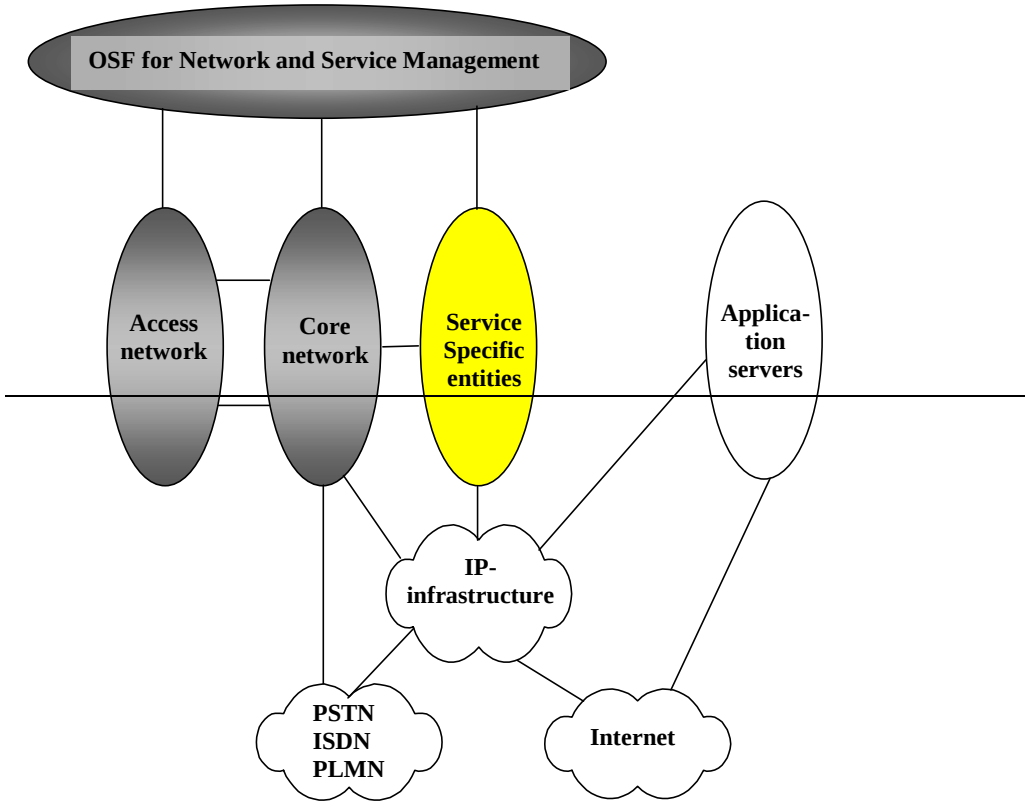
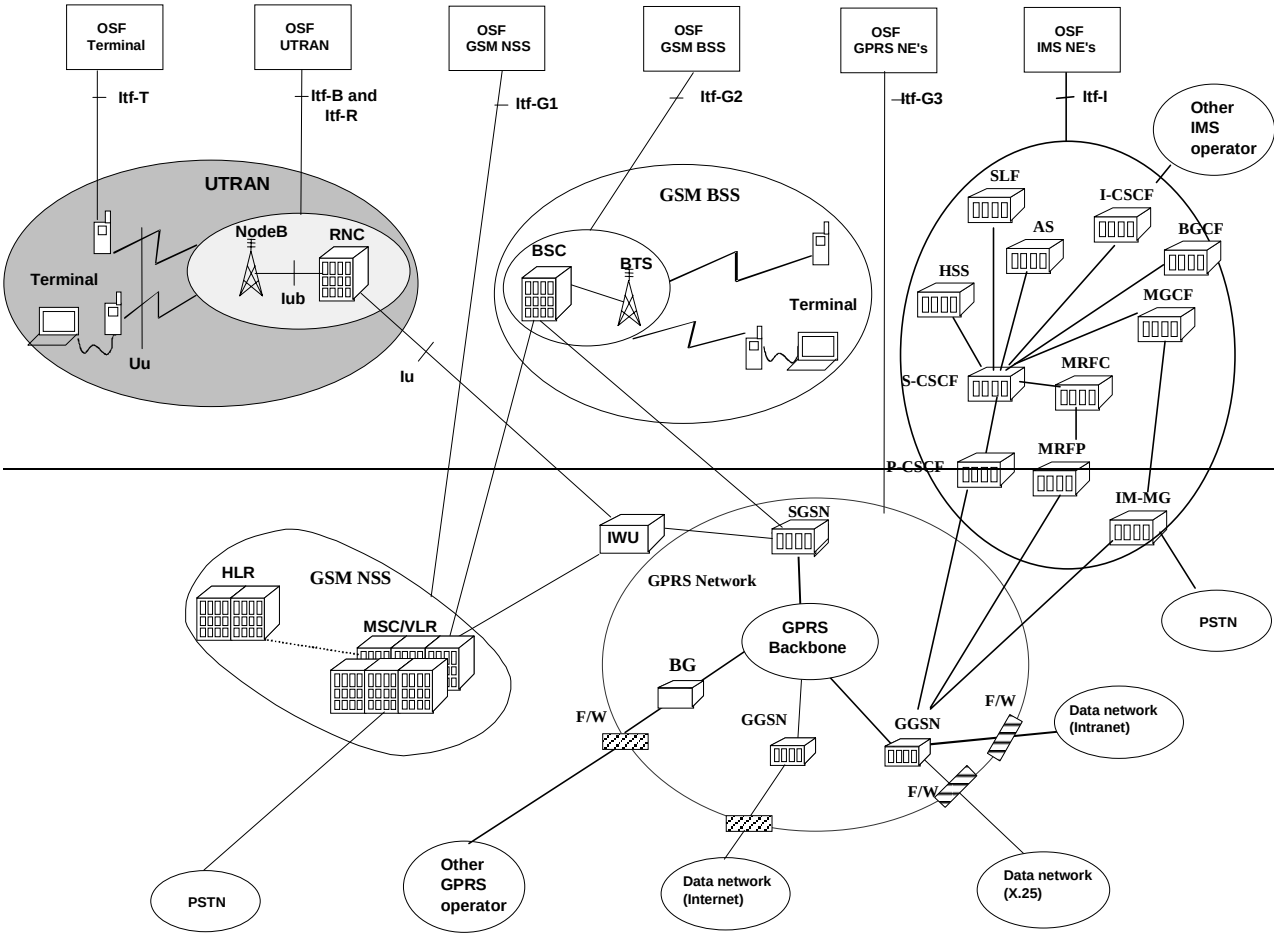


Figure 7.4 : High level UMTS Network architecture

Annex B (informative): Overview of a UMTS Network

Figure B.1 presents an example of a UMTS network, related management areas and introduces some management interfaces. UMTS Service specific entities are not shown.



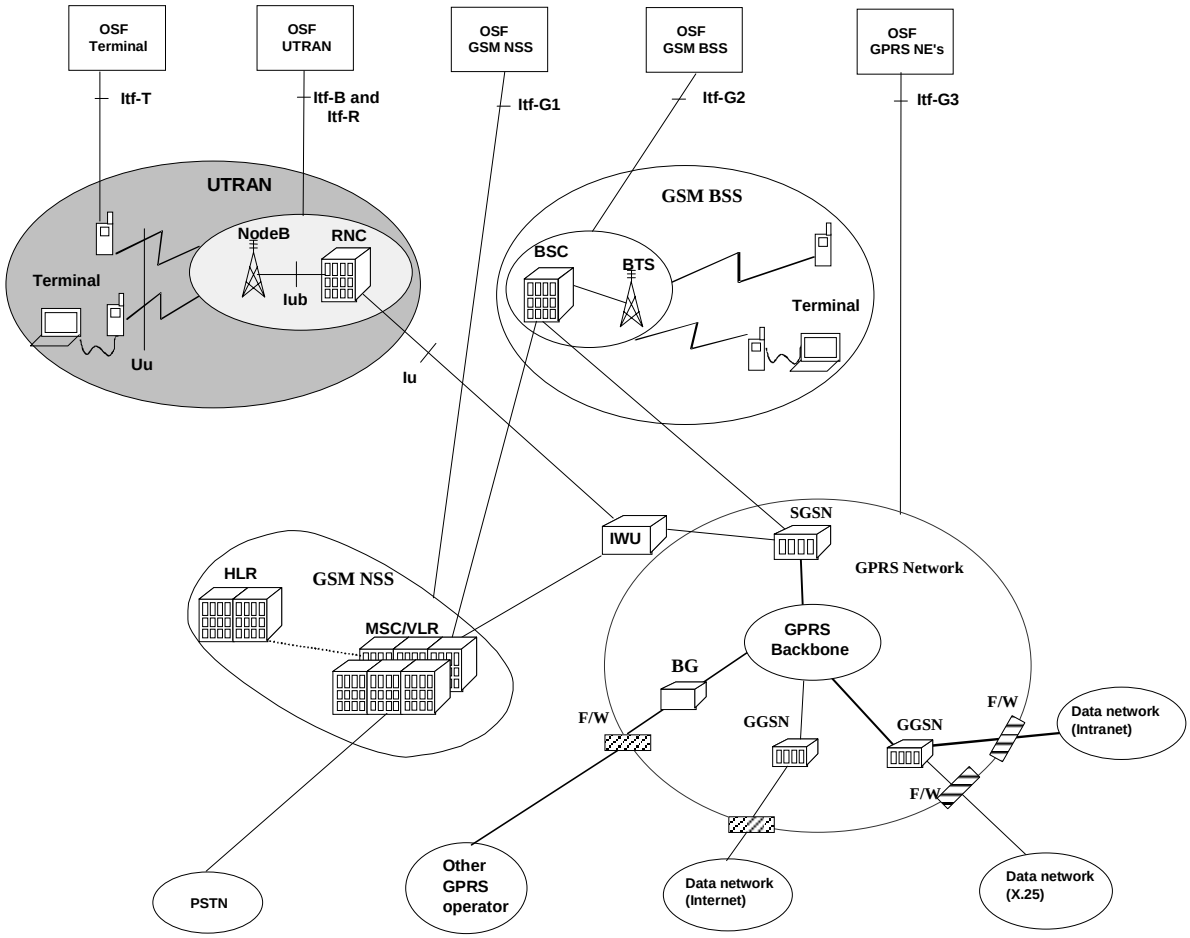


Figure B.1: Overview of a UMTS Network, showing management interfaces and management areas

All the following interfaces are illustrated in figure B.1:

- Itf-T between a terminal and a NE Manager. This interface will in some extent manage the 3G terminal and the USIM of the subscriber. Requirements of this interface are for further study.
- Itf-B and Itf-R between UTRAN and a NE Manager.
- Itf-G1 between GSM NSS and NE Manager.
- Itf-G2 between GSM BSS and NE Manager. This interface is standardised in GSM 12-series specifications.
- Itf-G3 between GPRS NEs and a NE Manager.

~~- Itf-I between the IMS and the NE manager.~~

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Tampere, Finland, 19 – 23 August 2002

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CHANGE REQUEST

⌘ **32.102** **CR** **021** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	IS Template Changes to support new UML Repertoire/Methodology
Source:	⌘	S5
Work item code:	⌘	OAM-AR
Date:	⌘	23/08/2002
Category:	⌘	**F**
Release:	⌘	REL-5

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A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
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2	*(GSM Phase 2)*
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R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Enable the documentation of an IS to be consistent and compliant with the new IRP Methodology
Summary of change:	⌘	• Modified attribute documentation table to have separate columns for support qualifier, read access, and write access • Added additional explanatory text to clarify template usage
Consequences if not approved:	⌘	IS documents will not be capable of supporting the level of detail enabled within the new IRP methodology

Clauses affected:	⌘	Annex C			
Other specs Affected:	⌘	Y / N	Other core specifications	⌘	
		N	Test specifications		
		Y	O&M Specifications		All TS 32.xxx IS documents
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary: …

~~X.3.a.2 Attributes~~

~~*-- The <attributes> sub-clause presents the list of attributes, which are the manageable properties of the object class . Each element is a pair (attributeName, supportQualifier).The supportQualifier indicates whether the attribute is Mandatory, Optional or Conditional (M, O, C).*~~

~~*-- this information is provided in a table. An example of such a table is given here below :*~~

~~Attribute name~~	~~Support Qualifier~~
~~ntfSubscriptionId~~	~~M~~

~~- Note : this sub-clause does not need to be present when there is no attribute to define.~~

X.3.a.2 Attributes

-- The <attributes> sub-clause presents the list of attributes, which are the manageable properties of the object class . Each element is a tuple (attributeName, visibilityQualifier, supportQualifier, readQualifer, writeQualifer)

- *The visibilityQualifier indicates whether the attribute is public, private or IRPAgent Internal ("+","—", and "%" respectively). The semantics of public and private are as per the UML specification. The semantic of IRPAgent Internal is defined within the 3GPP UML Repertoire.*
- *The supportQualifier indicates whether the attribute is Mandatory, Optional, Conditional or not supported ("M"," O"," C", or "—", respectively).*
- *The readQualifier indicates whether the attribute shall be readable by the IRPManager. The semantics for readQualifier is identical to supportQualifier, for "M, "O", and "—".*
- *The writeQualifier indicates whether the attribute shall be writeable by the IRPManager. The semantics for writeQualifier is identical to supportQualifier, for "M", "O", and "—".*

-- There is a dependency relationship between the supportQualifier and visibilityQualifier, readQualifier, and writeQualifier. The supportQualifier indicates the requirements for the support of the attribute. For any given attribute, regardless of the value of the supportQualifier, at least one of the reqdQualifier or writeQualifier must be "M". The implication of the "O" supportQualifier is that the attribute is optional, however the read and write qualifiers indicate how the optional attribute shall be supported, should the optional attribute be supported. Regardless of the supportQualifier, if an attribute is supported then it shall be supported in accordance with the specified visibilityQualifier.

-- Private or IRPAgent Internal attributes are per definition not readable by the IRPManager. Their readQualifier is hence always "—".

-- Private or IRPAgent Internal attributes are per definition not writable by the IRPManager. Their writeQualifier is hence always "—".

-- The readQualifier and writeQualifier of a supported atrribute, that is public, may not be both "—".

-- The use of "—" in supportQualifier is reserved for documenting support of attributes defined by an «Archetype» IOC. Attributes with a supportQualifier of "—" are not implemented by the IOC that is realizing a subset of the attributes defined by the «Archetype». The readQualifier and writeQualifier are of no relevance in this case. However, a not supported attribute is neither readable nor writable. For this reason the readQualifier and writeQualifier shall be "—" for unsupported attributes.

-- For any IOC that uses one or more attributes from an «Archetype», a separate table shall be used to indicate the supported attributes. This table is absent if no «Archetype» attributes are supported. For example, if a particular IOC has defined attributes (i.e., attributes not defined by an «Archetype») and encapsulates attributes from two «Archetype»s, then the totality of the attributes of said IOC will be contained in three separate tables.

-- This information is provided in a table. An example of such a table is given below:

Attribute name	Visibility	Support Qualifier	Read Qualifer	Write Qualifier
ntfSubscriptionId	+	M	M	O

-- Another example, where the support qualifier is "O" is given here below:

Attribute name	Visibility	Support Qualifier	Read Qualifer	Write Qualifier
ntfSubscriptionId	+	O	M	O

--In this example, the ntfSubscriptionId *is an optional attribute. If the implementation chose to support ntfSubscriptionId, then the said implementation is required to support read and may support write.*

- Note: this sub-clause does not need to be present when there is no attribute to define.

3GPP TSG-SA5 (Telecom Management) **S5-026750**

Meeting #30, Tampere, FINLAND, 19 - 23 August 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.102** CR **022** ⌘ rev **-** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Addition of 3GPP UML Repertoire for IRP: IS
Source:	⌘	S5
Work item code:	⌘	OAM-AR
Date:	⌘	23/08/2002
Category:	⌘	**F**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	This CR proposes UML repertoire for IRP:IS authors to use in their specifications. The intent is for production of IRP Information Services with consistent UML usage style.
Summary of change:	⌘	Add a new annex, as Annex G, for 32.102.
Consequences if not approved:	⌘	Inconsistent styles of UML model elements and notation usage will remain in future IRP Information Services.

Clauses affected:	⌘	Annex G (new)
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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] ITU-T Recommendation M.3010 (2000): "Principles for a telecommunications management network".

[2] 3GPP TS 32.101: "3G Telecom Management principles and high level requirements".

[3] Void

[4] ITU-T Recommendation X.200 (1994): "Information technology – Open Systems Interconnection – Basic reference model: The basic model".

[5] Void

[6] Void

[7] Void

[8] Void

[9] TMF GB910. Smart TMN Telecom Operations Map (Release 1.1).

[10] TMF GB909. Smart TMN Technology Integration Map (Issue 1.1).

[11] ITU-T Recommendation M.3013 (2000): “Considerations for a telecommunications management network”.

[12] 3GPP TS 23.002: "Network architecture (Release 4)".

[13] 3GPP TS 23.101: "General UMTS Architecture (Release 4)".

[14] 3GPP TS 32.111: "3G Fault Management".

[15] OMG Unified Modeling Language Specification, Version 1.4, September 2001

Annex G (normative):
IRP-IS UML Modeling Repertoire

G.1 Introduction

3GPP SA5 has chosen UML to capture systems behavior 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 annex 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 modeling 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.

All quotes are from [15].

Capitalized words are defined by various 3GPP IRP IS specifications or the reference [15].

G.2 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 Annex 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 (protocol) IRP (such as Alarm IRP: IS).

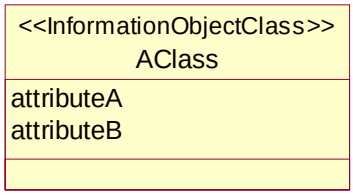
G.3 Model Elements and Notations

G.3.1 Basic model elements

UML defined a number of basic model elements. This section lists the selected subset for use in the repertoire. The semantics of the selected ones are defined in [15].

- attribute (Section 3.25 of [15]).

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

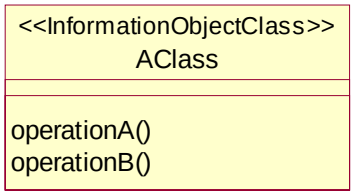


- aggregation (Section 3.43.2.5 of [15]).

  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 (Section 3.26 of [15]).

  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).

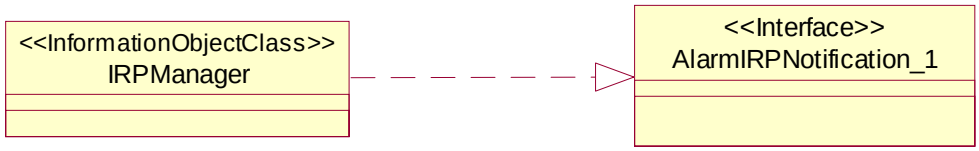


- association, association name (Section 3.41 of [15]).

  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 uni-directional (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 vise-versa.

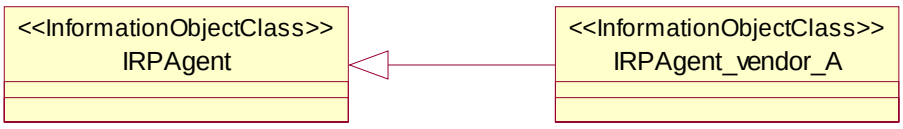
- realization relationship (Section 2.5.2.1 of [15]).

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



- generalization relationship (Section 3.50 of [15]).

  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.

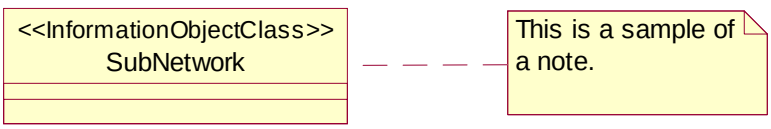


- dependency relationship (Section 3.51 of [15]).

  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.

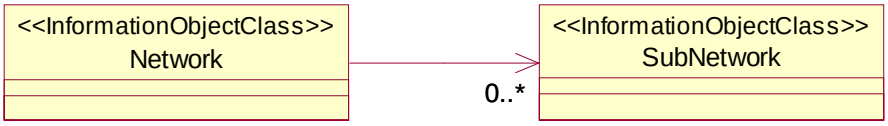
- note (Section 3.11 of [15])

  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 modeling elements by dashed lines.



- Multiplicity, a.k.a. cardinality (Section 3.44 of [15]).

  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 (Section 3.43.2.6 of [15]).

  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.

G.3.2 Stereotype

This sub-clause defines all allowable stereotypes that are summarized in the following table. Except <<Interface>>, <<Type>> and <<use>> (which are defined in [15]), all other stereotypes are extensions specifically designed for use in IRP IS specifications.

Table 1: Stereotypes

Stereotype	Base Class
Interface	Class
Type	Class
ProxyClass	Class
Archtetype	Classifier (section 2.5.2.10 of [15])
InformationObjectClass	Classifier
use	Association
may use	Association
may realize	Association
emits	Association
names	Aggregation
%	VisibilityKind (section 2.7.2.29 of [15])

G.3.2.1 <<Interface>>

Section 2.5.2.25 of [15]:

“An interface is a named set of operations that characterize the behavior 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.

…

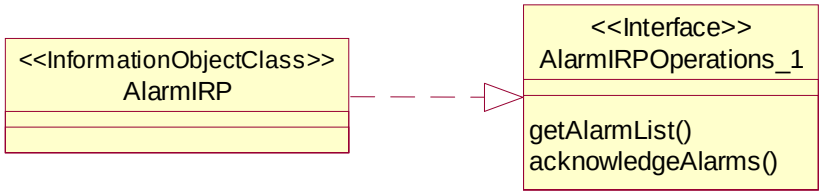
Interfaces may not have Attributes, Associations, or Methods. An Interface may participate in an Association provided the Interface cannot see the Association; that is, a Classifier (other than an Interface) may have an Association to an Interface that is navigable from the Classifier but not from the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

Section 2.5.4.6 of [15]: "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. Instantiable 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."

G.3.2.1.1 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 section "visibility"). The input and output parameters of the operations are hidden (i.e., not shown). The AlarmIRP has a unidirectional mandatory realisation relationship with the <<interface>>.

Figure 1 : <<Interface>> Notation



G.3.2.2 <<Type>>

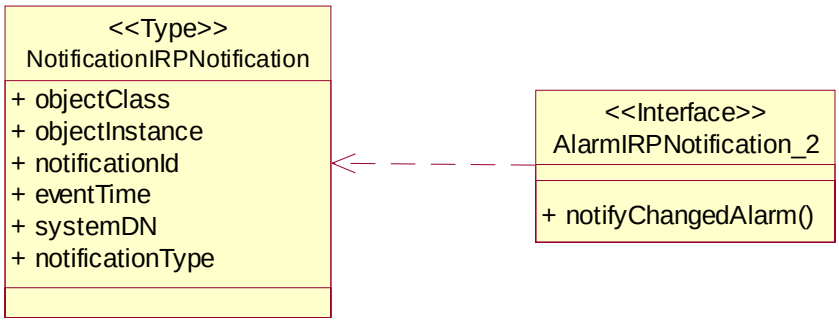
Section 3.28 of [15]: "[A Type is] a domain of objects together with the operations applicable to the objects, without defining the physical implementation of those objects. A Type may not contain any methods, maintain its own thread of control, or be nested. However, it may have Attributes and Associations. The Associations of a Type are defined solely for the purpose of specifying the behavior of the Type's operations and do not represent the implementation of state data."

G.3.2.2.1 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.

Figure 2: <<Type>> Notation



G.3.2.3 <<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 behavior other than those already defined by the represented <<InformationObjectClass>>.

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

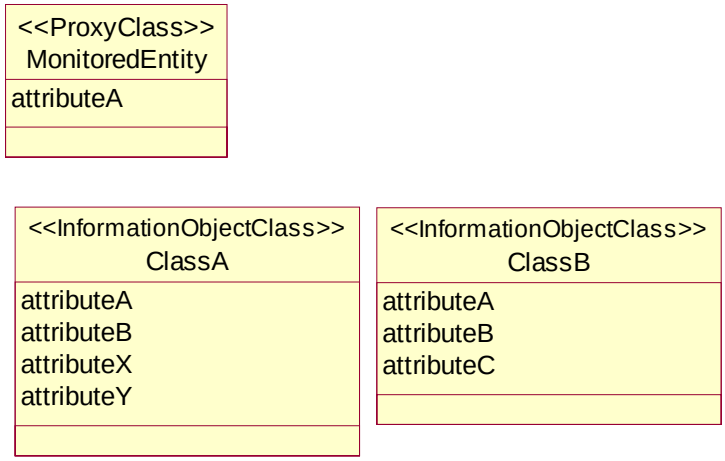
The attributes of the <<proxyClass>> are accessible by the source entity that has an association with the <<ProxyClass>>.

G.3.2.3.1 Sample

This shows a <<ProxyClass>> named MonitoredEntity. It represents all NRM <<InformationObjectClass>> (e.g., GgsnFunction <<InformationObjectClass>>) whose instances are being monitored for alarm conditions. The MonitoredEntity plays the role of theMonitoredEntity.

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

Figure 3: <<ProxyClass>>



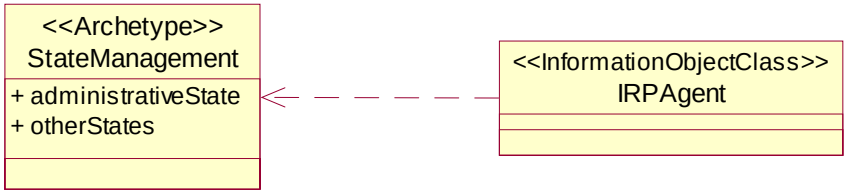
G.3.2.4 <<Archetype>>

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 place holder class that is most useful in technology neutral analysis models that will require further specification and/or mapping within a more complete construction model.

G.3.2.4.1 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.



G.3.2.5 <<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, behavior and relationships.

This <<InformationObjectClass>> and other information classes such as <<interface>> are mapped into technology specific model elements such as GDMO Managed Object Class for CMIP technology. The mapping of IS modeling constructs to technology specific modeling 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.

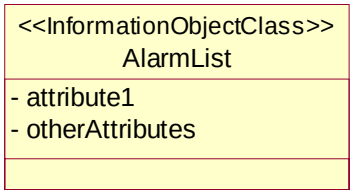
The <<InformationObjectClass>> is identical to UML *class* except that it does not include/define methods or operations.

Section 3.22.1 of [15]: "A *class* represents a concept within the system being modeled. Classes have data structure and behavior and relationships to other elements."

G.3.2.5.1 Sample

This sample shows an AlarmList <<InformationObjectClass>>.

Figure 4: <<InformationObjectClass>>> Notation



G.3.2.6 <<use>> and <<may use>>

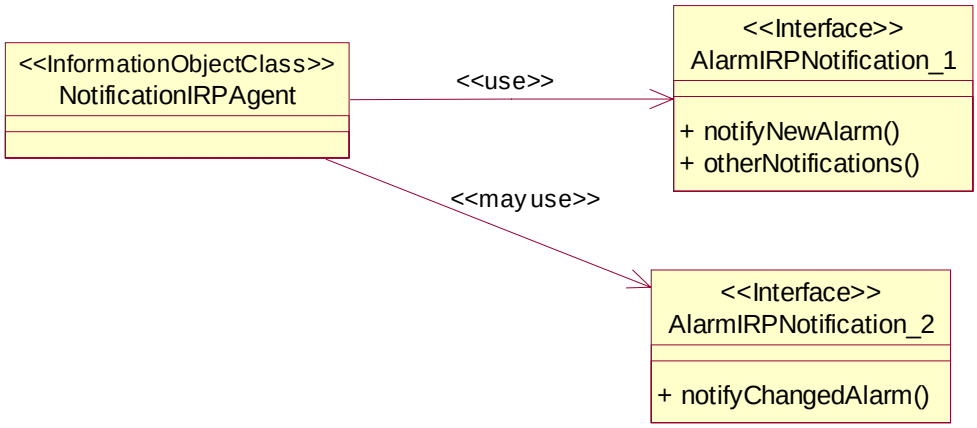
The <<use>> and <<may use>> are unidirectional associations. The target must be an <<interface>>. The <<use>> states that the source class must have the capability to use the target <<interface>> in that it can invoke the operations defined by the <<interface>>. Support of the capability by the source 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 itf-N.

G.3.2.6.1 Sample

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

Figure 5: <<use>> and <<may use>> Notation



G.3.2.7 Relationship realize and <<may realize>>

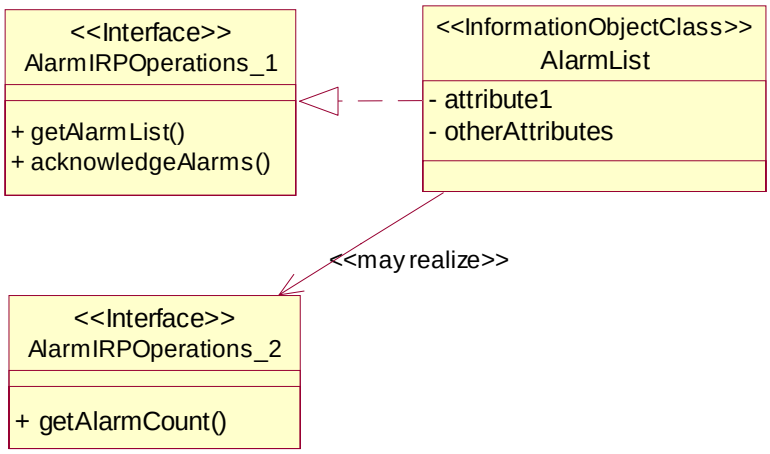
The relationship realize and <<may realize>> are unidirectional association. The target must be an <<interface>>. The relationship 'realize' shows that the source entity must realize the operations defined by the target <<interface>>. Realization of operations by the source entity is mandatory. The 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

G.3.2.7.1 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.

Figure 6: Relationship realize and <<may realize>> Notations



G.3.2.8 <<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 NotificationIRPManager.

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

G.3.2.8.1 Sample

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

Figure 7: <<emits>> Notation

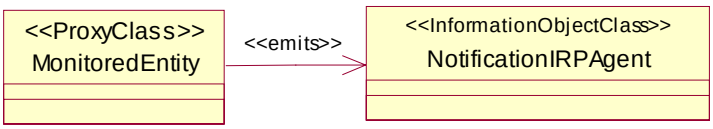
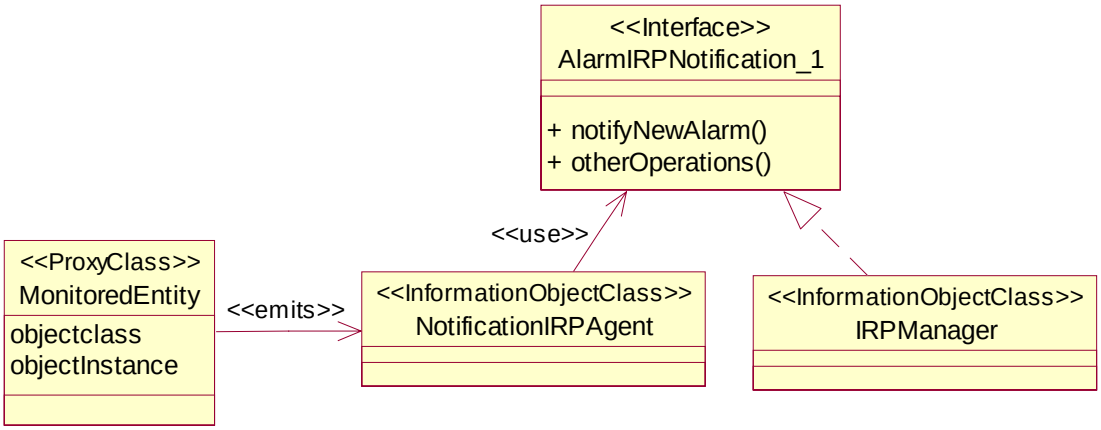


Figure 8: <<use>>, <<emits>> and realize relationship Notation



G.3.2.9 <<names>>

It specifies a unidirectional aggregation. 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 has the same <<name>> aggregation with the source.

A source can have multiple <<names>> with multiple targets. The set of <<names>> used between the source and its targets forms the source namespace.

A target can have multiple <<names>> with multiple sources, i.e., a target can participate/belong to multiple namespaces.

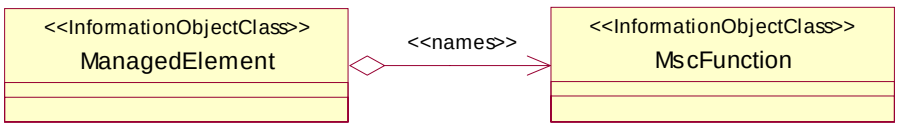
By convention, the name of the attribute in the target model element to hold part of the unique identification shall be formed by the name of the target class concatenated with “Id”.

When used in specifications, the label <<names>> can be omitted to reduce clutter and to improve readability of class diagrams.

G.3.2.9.1 Sample

This shows that all instances of MscFunction are uniquely identifiable within the ManagedElement namespace. Note the use of the label <<names>> in specifications is optional..

Figure 9: <<names>> Notation



G.3.3 Visibility

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

Table 2: 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

Table 3: 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 CM IRP Agent.

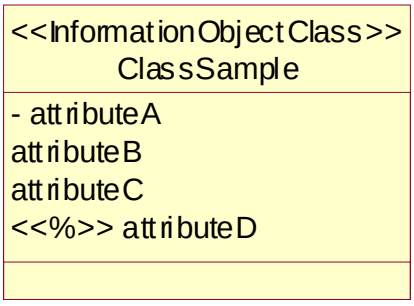
Table 4: IRPAgent Internal Visibility (notation '%')

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. (Note: no Release 5 operations are of this kind.)
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.

G.3.3.1.1 Samples

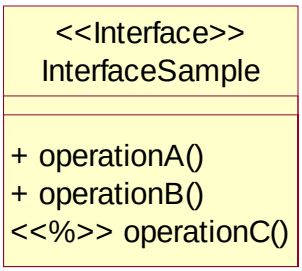
This sample shows four attributes whose visibility are private, public (default notation), public and IRPAgent Internal. It is recommended that within a Class symbol, the use of default notation or not for public visibility should be consistent, i.e., all "publicly visible" attributes shall be shown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

Figure 10: Visibility of attributes



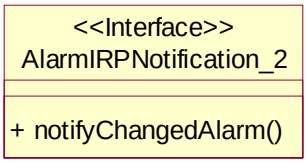
This sample shows three operations. Two of these operations are accessible by the IRPManager via the itf-N. It is recommended that within a Class symbol, the use of default notation or not for public visibility should be consistent, i.e., all “publicly visible” operation shall be shown with the “+” sign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

Figure 11: 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.

Figure 12: Visibility of notification



Annex ~~G~~H (informative): Change history