Technical Specification Group Services and System Aspects Meeting #18, New Orleans, USA, 9-12 December 2002

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Source: **SA5 (Telecom Management)**

Title: **2 Rel-5 CR 32.101/2 (Principles and high level requirements & Architecture) : Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc-1st-	Spec	CR	R	Phase	Subject	Cat	Version	Doc-2nd-	Workitem
SP-020726	32.101	020	-	Rel-5	Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)	F	5.1.0	S5-022326	OAM-AR
SP-020726	32.102	024	-	Rel-5	Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)	F	5.1.0	S5-022327	OAM-AR

3GPP TSG-SA5 (Telecom Management) **S5-022326**
Meeting #31, Atlanta/GEORGIA, USA, 7-11 October 2002

CR-Form-v7

CHANGE REQUEST

⌘ **32.101** **CR** **020** ⌘**rev** **-** ⌘ Current version: **5.1.0** ⌘

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

Title:	⌘	Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)
Source:	⌘	SA5
Work item code:	⌘	OAM-AR
Date:	⌘	22/11/2002
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)
Rel-6 (Release 6)

Reason for change:	⌘	The IRP related terminology in 32.101 is not aligned with all SWG-C IRP specifications.
Summary of change:	⌘	Correct the IRP terminology to be consistent with all IRP specifications. Some other minor (editorial) corrections are also suggested.
Consequences if not approved:	⌘	The IRP terminology would not be consistent between all IRP specifications, which leads to risk for wrong interpretation of the standards.

Clauses affected:	⌘	3

		Y	N			
Other specs affected:	⌘		X	Other core specifications	⌘	
			X	Test specifications		
		X		O&M Specifications		CR on 32.102 in S5-022327

Other comments:	⌘	This CR should be together with the CR on 32.102 in S5-022327. The changes do not introduce any modified requirements or technical solutions.

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.

3 Definitions and abbreviations

3.1 Definitions

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

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 and Sub-Network Management Functions.

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.

Enterprise Systems: ~~those~~ Information Systems that are used in the telecommunication organisation but are not directly or essentially related to the telecommunications aspects (Call Centre's, Fraud Detection and Prevention Systems, Invoicing etc).

Information Object~~.~~: E~~e~~ntity used to encapsulate information when modelling a network resource or a support object. The encapsulation has the form of "object classes". It is composed of a name, attributes, relationships and may support notifications and operations. Information Object Classes are independent from the specific implementation of the interface. Information objects are the only objects used to describe Information Services.

IRP (Integration Reference Point): An architectural concept that is described by a set of specifications for definition of a certain aspect of the Itf-N, comprising a **Requirements** specification, an **IRP Information Service** specification, and one or more **IRP Solution Set** specifications.

IRP Information Model: ~~An IRP Information Model consists of a combination of one or more~~A ~~generic term that represents the~~ **technology/protocol independent model** (information objects and/or interactions) of an IRP Information Service~~s and one or more Network Resource Models (see below for definitions of IRP Information Service and Network Resource Model)~~.

IRP Information Service (IS): An Information Service describes the information related to the entities (either network resources or support objects) to be managed and the way that the information may be managed for a certain functional area (e.g. the Alarm IRP Information Service in the fault management area). Information Services ~~can be~~are defined for all ~~types of~~ IRPs ~~as well as for NRMs~~.

~~**IRP Information Service:** An Information Service for a specific IRP.~~

IRP Solution Set (SS): ~~An IRP Solution Set c~~Contains a mapping of the IRP Information Service (IS) to one of several technologies. ~~(CORBA/IDL, CMIP/GDMO, SNMP/SMI etc.).~~ An IS can be mapped to several different Solution Sets. ~~(one for each technology).~~ Different technology selections may be made~~done~~ for different IRP Information Services. The functionality and information specified in a solution set is constrained by the functionality and information specified in the associated information service.

Managed Object~~.~~: ~~e~~Entity used to represent information in a~~n~~ Solution Set. The Managed Objects (MO) are obtained as the result of a mapping exercise of Information Objects defined in IS, taking into account some engineering choices and technology specificity.

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

Network Element (NE): ~~a~~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 Model (NRM): An Information Service ~~protocol independent model~~ describing Information Object Classes representing the manageable aspects of network resources, e.g. an RNC or NodeB. ~~In the Information Service, the model uses Information Object Classes. In the Solution Set, the model uses Managed Object Classes.~~

Operations System (OS): ~~This abbreviation i~~Indicates a generic management system, independent of its location level within the management hierarchy.

~~**Solution Set:** A Solution Set contains a mapping of an Information Service to one of several technologies (CORBA/IDL, SNMP/SMI, CMIP/GDMO, etc.). An Information Service can be mapped to several different Solution Sets (one for each technology). Solution Sets can be defined for IRPs as well as for NRMs. Different technology selections may be done for different Information Services.~~

Sub-Network Management Functions: ~~that are~~ Functions 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).

Support object~~-~~: ~~o~~Object that represents a particular capability, introduced to model a service. As an example of support object, for the Alarm IRP Information Service there is the "alarm information" and "alarm list".

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:

API	Application Programming Interface
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
B2B	Business to Business
B-ISDN	Broadband ISDN
BOOTP	Boot protocol
CLI	Command Line Interface
CMIP	Common Management Information Protocol
CMIP/GDMO	Common Management Information Protocol/Guidelines for the Definition of Managed Objects
COPS	Common Open Policy Service
COPS-PR	COPS Usage for Policy Provisioning
CORBA IIOP	Common Object Request Broker Architecture Internet Inter-ORB Protocol
CORBA	Common Object Request Broker Architecture
CORBA/IDL	Common Object Request Broker Architecture/Interface Definition Language
DCN	Data Communications Network
DECT	Digital Enhanced Cordless Telecommunications
DHCP	Dynamic Host Configuration Protocol
DNS	Directory Name Service
DSS1	Digital Subscriber System 1
EM	Element Manager
EMS	Element Management System
FFS	For Further Study
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
ftp	FTP
GDMO	Guidelines for the Definition of Managed Objects
GSM	Global System for Mobile communications
HLR	Home Location Register
HSS	Home Subscriber Server
IDL	Interface Definition Language
IETF	Internet Engineering Task Force
IIOP	Internet Inter-ORB Protocol
IN	Intelligent Network
INAP	Intelligent Network Application Part

IRP	Integration Reference Point
IS	Information Service
ISDN	Integrated Services Digital Network
LDAP	Lightweight Directory Access Protocol
LDUP	LDAP Duplication/Replication/Update Protocols
LLA	Logical Layered Architecture
MAP	Mobile Application Part
MExE	Mobile Execution Environment
MIB	Management Information Base
MMI	Man-Machine Interface
NM	Network Manager
NMS	Network Management System
NRM	Network Resource Model
OS	Operations System
OSI	Open Systems Interconnection
OSS	Operations Support System
PCF	Policy Control Function
PDH	Plesiochronous Digital Hierarchy
PDP	Policy Decision Point
PIB	Policy Information Base
PKI	Public Key Infrastructure
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RNC	Radio Network Controller
RSVP	Resource ReserVation Protocol
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol (IETF)
SNMP/SMI	SNMP/Structure of Management Information
SOM	Service Operations Management
SS	Solution Set
SS7	Signalling System No. 7
TCP/IP	Transmission Control Protocol/ Internet Protocol
tftp	trivial ftp
TM	Telecom Management
TMF	TeleManagement Forum
TMN	Telecommunications Management Network (ITU-T)
TOM	Telecom Operations Map (TMF)
UML	Unified Modelling Language
UMTS	Universal Mobile Telecommunication System
UPT	Universal Personal Telecommunication
USIM	Universal Subscriber Identity Module
UTRA	Universal Terrestrial Radio Access
VHE	Virtual Home Environment

3GPP TSG-SA5 (Telecom Management) **S5-022327**
Meeting #31, Atlanta/GEORGIA, USA, 7-11 October 2002

CR-Form-v7

CHANGE REQUEST

⌘ **32.102** **CR** **024** ⌘**rev** **-** ⌘ Current version: **5.1.0** ⌘

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Clauses affected:	⌘	3, 10.4, 10.5

	Y	N			
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
		X		O&M Specifications	32.101

Other comments:	⌘	This CR should be together with 32.101CR020 in S5-022326. The changes do not introduce any modified requirements or technical solutions.

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3 Definitions and abbreviations

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: see IRP 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.

IRP: defined in 3GPP TS 32.101 [2]. **(Integration Reference Point):** A set of specifications for definition of a certain aspect of the Itf-N, comprising a **Requirements** specification, an **IRP Information Service or a Network Resource Model** specification, and one or more **IRP Solution Set** specifications. For more elaborate description of the IRP concept and architecture, see clause 10.

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(s) and it interacts directly with the IRPAgent(s) using the IRP(s). Since the IRPManager represents an IRPAgent user, they help delimit the IRPAgent and it gives 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: 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(s) and it interacts directly with the IRPAgent(s) using the IRP(s). Since the IRPManager represents an IRPAgent user, they help delimit the IRPAgent and it gives 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]~~see IRP Solution Set.

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	Cell 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
EM	Element Manager
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
NM	Network Manager
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

10 Integration Reference Points (IRPs)

● ● ●

10.4 Defining the IRPs

It is important to accommodate more than one specific technology, as the technologies will change over time. Applications need to be future-proof. One fundamental principle for achieving this is to clearly separate the semantics of information definition from the protocols definitions (accessing the information) for the external interfaces.

The framework being used to define IRPs allows the implementation of user requirements for each management capability (e.g. configuration management), by modelling the information related to the resources to be managed and the way that the information may be accessed and manipulated. Such modelling is done in a way that is independent of the technology and distribution used in the implementation of a management system.

An IRP for a management capability is composed of three~~3 types~~ levels of specifications~~documents~~. The first ~~type~~ level of IRP specification ~~document~~ captures the ~~user~~ **requirements** ~~and, if applicable, modelling requirements~~.

The second ~~type~~ level of IRP ~~document~~specifications~~,~~ known as "**IRP Information Service**", specifies the **information** observable and controlled by management system's client, related to the network resources under management, in a technology independent~~/protocol neutral~~ way. This~~e~~ IS-level document also specifies the semantics of the interactions used to carry ~~these~~ applicable information.

The third ~~type~~ level of IRP specification~~document~~, known as ~~"~~**IRP Solution Set**~~"~~, contains specification of the system in terms of ~~communication/protocol~~ interface technology choice (e.g. CMIP/GDMO, CORBA/IDL). In this type of specification, the syntax, rather than the semantics, ~~are~~is specified. At least ~~O~~one instance of a Solution Set ~~document~~ is produced per ~~communication~~interface technology supported.

The IRP methodology uses the following steps:

a. Capture the management requirements.
b. Specify the semantics of the information to describe the system. Trace back to item (a).
c. Specify the semantics of the interactions between the management system and its clients. ~~-~~Trace back to item (a).
d. Specify the syntaxes of the information and interactions identified in (b) and (c). ~~-~~The specification is technology dependent. ~~-~~Trace back to items (b) and (c)

~~The set of resources that form an NRM can also be described using the requirement documents and the Information Service (without the part on information access). Both the NRM and IRP Information Service definitions are used to define Solution Sets to develop management capabilities at, for example a CORBA based interface.~~

As presented above, the Information Service document may contain two parts, the information related to the resources to be managed and the way that the information may be manipulated.

The first part defines the information types within a distributed system. It is in line with the Analysis phase of ITU-T M.3020. From the point of view of the Network Level modelling work it reflects the information aspects (including states and significant transitions) of the managed resources and the management services. It defines information object classes, the relationships between these object types, their attributes and states along with their permitted state transitions. It may also define the allowable state changes of one or more information objects. As recommended in M.3020, UML diagrams (class diagram, state diagram) are used to represent information when appropriate. This rest of the specification is described using an information description specified in natural language with appropriate label keywords (e.g. DEFINITION, ATTRIBUTE, CONSTRAINTS, etc…). A definition of the IS information template is provided in Annex C.

Management service specific information objects may be created by subclassing from the objects in the basic network model, and extending them for that application. In this case, the new management service specific subclass may include other attributes, in addition to those defined in its superclass. Additional relationships and attributes may also be created as needed for that management service. Completely new objects can also be added.

The second part defines interfaces. Each interface contains one or more operations or one or more notifications that are made visible to management service users. An interface encapsulates information exchanged that is atomic in the sense that either all the information exchanged are visible (to management service users) or none. In addition, the specification of the information exchanged is in semantics only. No syntax or encoding can be implied. The operations or notifications are defined with their name, input and output parameters, pre and post conditions, raised exceptions and operation behaviour. These operation and notification specifications refer, through the utilisation of parameter matching, to the information objects. A definition of the IS operations/notifications template is provided in Annex C.

The Solution Set ~~document~~ contains the mapping of the information objects and interactions (if applicable) specified in the IS-level specification, into their corresponding syntaxes of a particular chosen technology. The mapping is ~~infrastructure~~ interface technology~~/protocol~~ specific and satisfies scenarios where interfaces have been selected, according to mapping choices (driven for example by system performance, development cost, time to market). The mapping is not always one-to-one. General rules valid for all IRP Solution Sets are defined in Annex E~~D~~. Rules for specific Solution Sets, such as CORBA, are defined in an Annex to this TS ~~for~~ as well as within each of the Solution Set technologies used by 3GPP (as applicable).

Managed Object Classes as defined in a CMIP or CORBA Solution Set document represents a mapping into GDMO or IDL of Information Object Classes and other additional objects classes that can be introduced to support interfaces defined in the Information Service. Whether instances of Managed Object Classes are directly accessible or not may not be specified by IRP specifications.

Figure 10.4~~2~~ shows an example of how an IRP can be structured (the Alarm IRP). Note that Figure 10.4~~2~~ is only an example of what could be the Alarm IRP~~;~~, the Alarm IRP specified in GPP TS 32.111 [14] can be different.

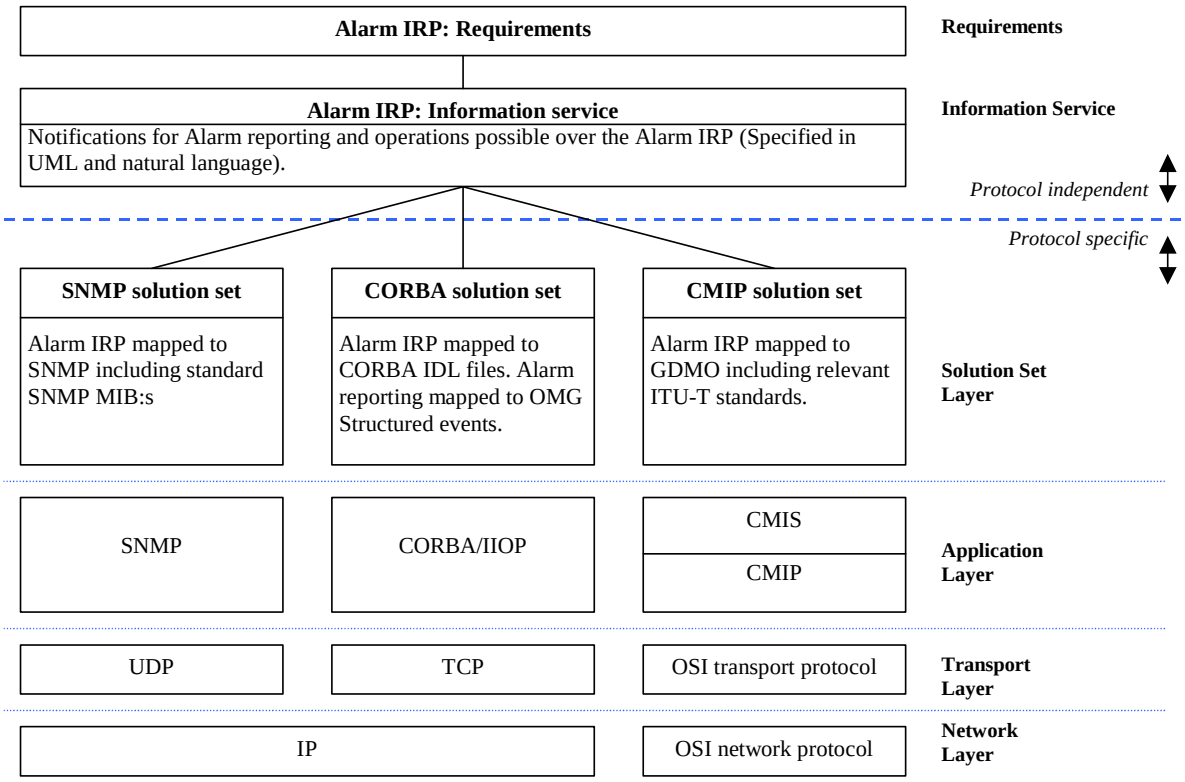

Figure 10.42: Example of an IRP (Alarm IRP)

10.5 Relationships between IS-level specifications

This subclause presents the target architecture of the SA5 ~~Network Resources Models, Information Services and~~ IRP Information Models. This architecture is based on the concepts of level and partition of information. To achieve this, information object classes (IOCs) and interfaces are defined and grouped into packages ~~which~~ that can be related to each other~~s~~ through the ~~import~~ *import* relationship.

Level means that the information ~~services~~ models are structured in a way that enables re-utilization between levels, either through inheritance or through a traditional relationship between classes. Four levels are identified, namely:

1. A ~~g~~**G**eneric **Network Resource Model** ~~**IS**~~, also called "Generic NRM", which defines the information object classes ~~and interfaces~~ that are independent of any 1/ protocol (e.g. CORBA / IDL, CMIP / GDMO, etc.) and 2/ "~~sub-~~domain specific network" (e.g. UTRAN, GERAN, CN). This Network Resource Model contains definitions of the largest subset of information object classes that are common to all the Network Resources Models to be defined in SA5. This Network Resources Model is part of Level 1. For this Information Service, a number of solution sets may be provided;

2. A number of ~~d~~**D**omain-specific **Network Resource Model**~~**IS**~~**s**. ~~Up to now, three Network Resource Models of this type have been identified~~Examples of these are: the CN Model, the UTRAN Model and the GERAN Model. They are part of Level 2. These Network Resource Models are specified in corresponding packages and import information object classes from the Generic Network Resources Model defined in Level 1. For each of these Information Services, a number of solution sets may be provided;

3. A number of **function-specific ISs**. Such information services as the Basic CM~~m~~ IRP IS, the Notification IRP IS and the Alarm IRP IS are part of this level. They are part of Level 3. These Information Services are specified in corresponding packages and may import information object classes and interfaces defined in Level 1 and 2. For each of these Information Services, a number of solution sets may be provided;

4. A number of (interface technology~~/protocol~~-independent) **Information Models**. Up to now, none of them have been defined. They will be part of Level 4. These Information Models are specified in corresponding packages and may import information object classes and interfaces defined both in Level 1, 2 and ~~in Level~~ 3. An example of such Information Model ~~is~~ could be a "UTRAN Alarm IM" (see Figure 10.5~~3~~). For each of these Information Models, a number of solution sets may be provided;

These levels provide a means for separation of concerns and re-utilization.

~~NRM and IRP~~ ISs shall be kept as simple as possible. To achieve this, information object classes and interfaces shall be grouped into packages. The grouping shall be based on semantics, i.e. information object classes and interfaces ~~which~~ that participate ~~to~~ in the definition of a given IRP ~~or NRM~~ should be gathered into a dedicated package. See further example(s) on this in Annex D.

Re-utilization of information specification contained in an ~~NRM or IRP~~ IS previously specified shall be possible through the *import* relationship. The import relationship is a means for re-utilization : once a piece of information (i.e. an information object class, an attribute, a relationship or an interface) defined in an ~~NRM or IRP~~ IS is imported in another ~~NRM or IRP~~ IS, it is added to the name space of the importing ~~NRM or IRP~~ IS. Then, the whole information available in a ~~NRM or IRP~~ IS is made up of the information which is owned by the ~~NRM or IRP~~ IS itself (i.e. defined in this document) plus the information which is imported from other ~~NRM(s) or IRP~~ IS(s). This imported information can then be utilised in the importing ~~NRM or IRP~~ IS, for instance, through:

- inheritance (e.g. any information object class defined at Levels 2 to 4 inherits from the information object class Top defined in the generic NRM at Level 1), either directly or indirectly;

- relationship (e.g. any information object class defined at Levels 2 to 4 may have a containment relationship with the information object class IRPAgent defined in the generic NRM at Level 1).

An illustration of this architecture is provided in figure 10.5~~3~~ below; it uses the UML diagrammatic conventions.

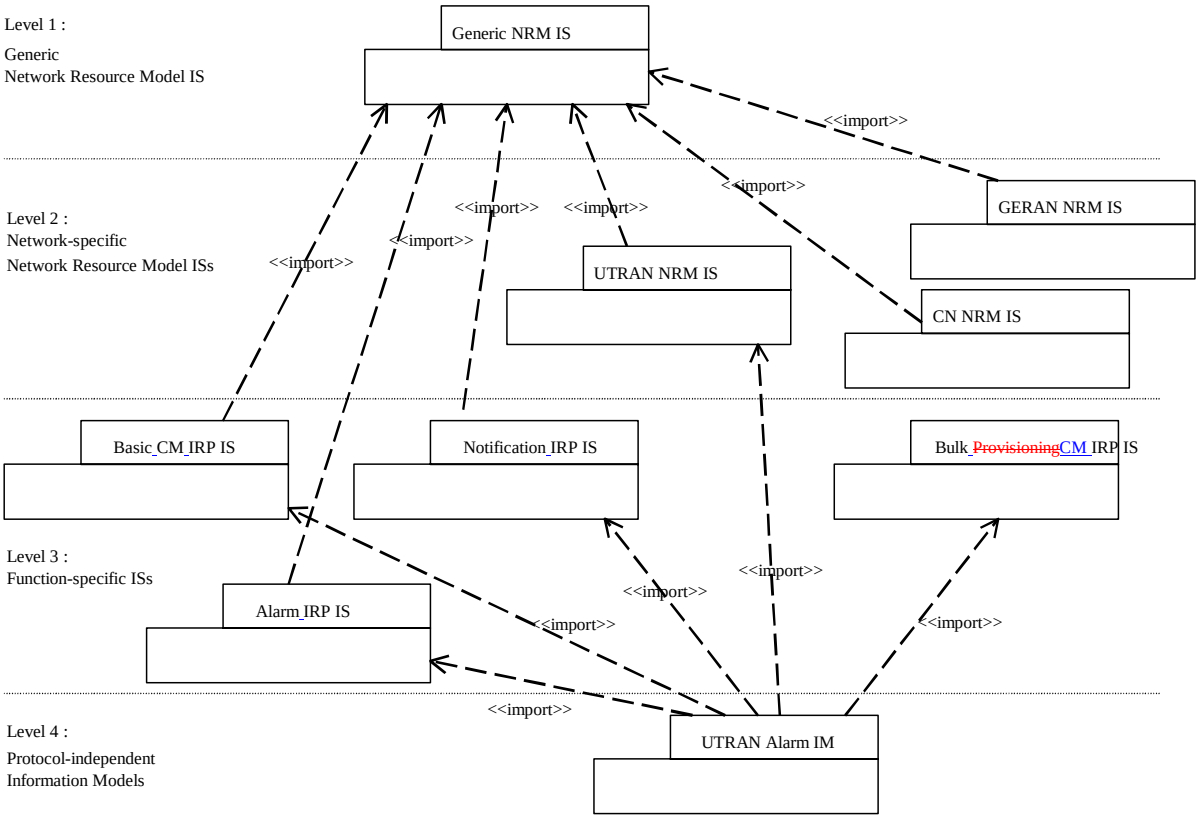

Figure 10.5~~3~~: Specification architecture (not complete)

In order not to mix up the concept of “information object class” and “interface” with other concepts such as “managed object class” and “manager / agent interface”, the former are labelled according to the UML notation capability (cf. stereotype). “Information object class” is defined as a stereotype of “Class” in the UML meta-model. As a consequence, information object classes defined in Information Models are labelled <<InformationObjectClass>>. Similarly, interfaces are labelled <<Interface>>. In Annex C you can find an example of the inheritance between some ISs.

The following piece of information regarding the Semantics of the relationship "import" can be imported from other standard documents:

1. An information object class. The definition of the IOC, the attributes and the roles that the IOC plays in some relationships are imported. The import clause shall specify the TS number from which the IOC is imported and the name of the IOC;

2. An attribute. Two cases ~~can happen~~are valid~~ -~~:

   2.1. An attribute definition. In this case, the attribute definition is imported. The import clause shall specify the TS number from which the attribute is imported and the name of the attribute;

   2.2. An attribute reference within an IOC definition. In this case, the attribute definition is imported together with its qualifier within the specified IOC. The import clause shall specify the TS number from which the attribute is imported, the name of the IOC and the name of the attribute;

3. A relationship. The definition of the relationship is imported. The import clause shall specify the TS number from which the relationship is imported and the name of the relationship;

4. An interface. The definitions of the interface and all its operations or notifications are imported. The import clause shall specify the TS number from which the interface is imported and the name of the interface;

5. An operation or a notification. The definition of the operation / notification is imported. The import clause shall specify the TS number from which the operation / notification is imported, the name of the interface in which the operation / notification is defined and the name of the operation / notification;

A piece of information **must** always be imported from the TS where it is initially defined. It cannot be imported from any other.

10.6 Mandatory, Optional and Conditional qualifiers

This subclause defines a number of terms used to qualify the relationship between the 'Information Service', the 'Solution Sets' and their impact on the IRP implementations. The qualifiers defined in this clause are used to qualify IRPAgent behaviour only. This is considered sufficient for the specification of the IRPs.

Table 1 defines the meaning of the three terms Mandatory, Conditional and Optional when they are used to qualify the relations between operations, notifications and parameters specified in 'Information Service' documents and their equivalents in Solution Set (SS) documents.

Table 1: Definitions of Mandatory, Optional and Conditional Used in Information Service Documents

	Mandatory (M)	Conditional (C)	Optional (O)
Operation and Notification	Each Operation and Notification shall be mapped to its equivalents in all SSs. Mapped equivalent shall be M.	Each Operation and Notification shall be mapped to its equivalents in at least one SS. Mapped equivalent can be M or O.	Each Operation and Notification shall be mapped to its equivalents in all SSs. Mapped equivalent shall be O.
Input and output parameter	Each parameter shall be mapped to one or more information elements of all SSs. Mapped information elements shall be M.	Each parameter shall be mapped to its equivalent in at least one SS. Mapped equivalent can be M or O.	Each parameter shall be mapped to its equivalent in all SSs. Mapped equivalent shall be O.
Information relationship	Each relationship shall be supported in all SS's.	Each relationship shall be supported in at least one SS.	Each relationship shall be supported in all SS's.
Information attribute	Each attribute shall be supported in all SS's.	Each attribute shall be supported in at least one SS.	Each attribute shall be supported in all SS's.

Table 2 defines the meaning of the two terms Mandatory and Optional when they are used to qualify the operations, parameters of operations, notifications and parameters of notifications in Solution Sets.

Table 2: Definitions of Mandatory and Optional Used in Solution Set Documents

Mapped SS Equivalent	Mandatory	Optional
Mapped notification equivalent	IRPAgent shall generate it.	IRPAgent may or may not generate it.
Mapped operation equivalent	IRPAgent shall support it.	IRPAgent may or may not support this operation. If the IRPAgent does not support this operation, the IRPAgent shall reject the operation invocation with a reason indicating that the IRPAgent does not support this operation. The rejection, together with a reason, shall be returned to the IRPManager.
input parameter of the mapped operation equivalent	IRPAgent shall accept and behave according to its value.	IRPAgent may or may not support this input parameter. If the IRPAgent does not support this input parameter and if it carries meaning (i.e., it does not carry no-information semantics), the IRPAgent shall reject the invocation with a reason (that it does not support the parameter). The rejection, together with the reason, shall be returned to the IRPManager.
Input parameter of mapped notify equivalent AND output parameter of mapped operation equivalent	IRPAgent shall generate it.	IRPAgent may generate it.