

Source: SA5

Presentation of Specification to TSG SA

Presentation to:	TSG SA Meeting #6
Document for presentation:	3G TS 32.101 V2.0.0 <i>3G Telecom Management principles and high level requirements</i>
Presented for:	Approval

Abstract of document:

This document establishes and defines the management principles and high level requirements for the management of UMTS.

In particular, the present document identifies the requirements for:

- the upper level of a UMTS Management System;
- the reference model, showing the elements the UMTS Management System interacts with;
- the network operator processes needed to run, operate and maintain a UMTS network;
- the functional architecture of the UMTS Management System;
- the principles to be applied to UMTS Management Interfaces;
- the methodology to be followed in further steps of the UMTS Management Specifications

The present document does not provide physical architectures of the UMTS Management System. These aspects are defined and discussed in more detail in 3G TS 31.102 [101].

This document is applicable to all further 3GPP specifications regarding the Network Management of UMTS.

Changes since last presentation to TSG-SA Meeting # 5

Outstanding Issues:

See list of outstanding R99 issues on the following page

Contentious Issues:

none identified

Release 1999 Submission form

Work Area / Item:		TS 32.101 - 3G Telecom Management principles and high level requirements			
Affects:	UE/MS:	CN:	UTRAN:	Compatibility Issues:	Yes: No:
Expected Completion Date:		March 2000 for the outstanding issues mentioned below			
Services impacted:					
Specifications affected:					
Tasks within work which are not complete:			<ol style="list-style-type: none"> 1. Resolve Inconsistency between 32.101 and 32.102 regarding the use of X.25 as a Network Layer Protocol 2. Add a Security Management Section 		
Consequences if not included in Release 1999:					
Accepted by TSG: SA#6			for late inclusion in Release 1999:		

3G TS 32.101 V2.0.0 (1999-12)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
3G Telecom Management principles and high level
requirements
(3G TS 32.101 version 2.0.0)**



Reference

3TS/TSGSA-0532101U

Keywords

Management principles

3GPP

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Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

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- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

The present document establishes and defines the management principles and high level requirements for the management of UMTS.

In particular, the present document identifies the requirements for:

- the upper level of a UMTS Management System;
- the reference model, showing the elements the UMTS Management System interacts with;
- the network operator processes needed to run, operate and maintain a UMTS network;
- the functional architecture of the UMTS Management System;
- the principles to be applied to UMTS Management Interfaces;
- the methodology to be followed in further steps of the UMTS Management Specifications

The present document does not provide physical architectures of the UMTS Management System. These aspects are defined and discussed in more detail in 3G TS 31.102 [101].

This document is applicable to all further 3GPP specifications regarding the Network Management of UMTS.

2 References

2.1 Normative references

- [1] ITU-T Recommendation M.3010 (1996): "Principles for a telecommunications management network".
- [2] 3G TS 22.101 "Universal Mobile Telecommunication System: Service Aspects; Service Principles (V3.2.1)"
- [3] GSM 12.11 Fault Management of the Base Station System (TS 101 251 version 6.2.0 Release 1997)
- [10] IETF RFC 959 File Transfer Protocol (FTP), October 1985, J. Postel, J. Reynolds, ISI.
- [11] IETF RFC 783 Trivial File Transfer Protocol (TFTP) revision 2, June 1981, K.R. Sollins MIT.
- [15] IETF Network Working Group RFC 1157 A Simple Network Management Protocol (SNMP), May 1990, J. Case, SNMP Research, M. Fedor, Performance Systems International, M. Schoffstall, Performance Systems International, J. Davin, MIT Laboratory for Computer Science.
- [20] [53] The Common Object Request Broker: Architecture and Specification, Revision 2.3, June 1999
- [25] [RFC2401] Security Architecture for the Internet Protocol, IETF, November 1998
- [30] CCITT M.3010 (1988): "Principles for a Telecommunications Management Network (TMN).
- [31] CCITT Draft Q.811 (1992): "Lower Layer Protocol Profiles for the Q3 Interface".
- [32] CCITT Draft Q.812 (1992): "Upper Layer Protocol Profiles for the Q3 Interface".
- [33] CCITT G.703 (1988): "Physical/Electrical Characteristics of Hierarchical Digital Interfaces".
- [34] ISO DIS 7498-3 (1987): "Information Processing Systems - Open Systems Interconnection - OSI Reference Model - Part 3: Naming and Addressing".

- [35] ISO DIS 7498-4 (1987): "Information Processing Systems - Open Systems Interconnection - OSI Reference Model - Part 4: Management Framework".(See also CCITT X.700)
- [36] ISO IS 8571-1: "Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management - Part 1: General Introduction".
- [37] ISO IS 8571-2: "Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management - Part 2: Virtual Filestore Definition".
- [38] ISO IS 8571-3: "Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management - Part 3: File Service Definition".
- [39] ISO IS 8571-4: "Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management - Part 4: File Protocol Specification".
- [40] ISO/IEC ISP 10607-1: "Information technology - International Standardized Profiles AFTnn - File Transfer, Access and Management - Part 1: Specification of ACSE, Presentation and Session Protocols for the use by FTAM".
- [41] ISO/IEC ISP 10607-2: "Information technology - International Standardized Profiles AFTnn - File Transfer, Access and Management - Part 2: Specification of Document Types, Constraint sets and Syntax's".
- [42] ISO/IEC ISP 10607-3: "Information technology - International Standardized Profiles AFTnn - File Transfer, Access and Management - Part 2: Specification of AFT 11 Simple File Transfer Service (Unstructured)".
- [43] ISO/IEC DISP 11183-1: "Information technology - International Standardized Profiles AOMnn.OSI Management - Management communication protocols -Part 1: Specification of ACSE, presentation and session protocols for the use by ROSE and CMISE".
- [44] ISO DIS 9545 (1988): "Information Processing Systems - Open Systems Interconnection - Application Layer Structure".
- [45] ISO IEC 9595 (1991): "Information technology - Open Systems Interconnection - Common Management Information Service Definition". (See also X.710)
- [46] ISO IEC 9596-1 (1991): "Information technology - Open Systems Interconnection - Common Management Information Protocol - Part 1 Specification". (See also X.711)
- [47] CCITT X.21: "Interface between data terminal equipment and data circuit-terminating equipment for synchronous operation on public data networks".
- [48] CCITT X.21 bis (1988): "Use on public data networks of data terminal equipment (DTE) which is designed for interfacing to synchronous V-Series modems".
- [49] CCITT X.25 (1988): "Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating (DCE) for Terminals operating in the Packet Mode and connected to Public Data Networks by Dedicated Circuit".
- [50] CCITT X.121 (1988): "International Numbering Plan for Public Data Networks".
- [51] CCITT X.200 (1988): "Reference Model of Open Systems Interconnection for CCITT Applications". (see also ISO 7498)
- [52] CCITT X.208 (1988): "Specification of Abstract Syntax Notation One (ASN.1)". (see also ISO 8824 and ISO 8824-AD1)
- [53] CCITT X.209: "Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)". (see also ISO 8825 and ISO 8825-AD1)
- [54] CCITT X.210 (1988): "Open Systems Interconnection (OSI) Layer Service Definition Conventions".

- [55] CCITT X.211 (1988): "Physical Layer Service Definition for Open System Interconnection (OSI) for CCITT applications".
- [56] CCITT X.212 (1988): "Data Link Service Definition for Open System Interconnection (OSI) for CCITT applications".
- [57] CCITT X.213 (1988): "Network Service Definition for Open System Interconnection (OSI) for CCITT applications". (see also ISO 8348, ISO 8348/AD2 and ISO 8348/AD3)
- [58] CCITT X.223 (1988): "Use of X.25 to provide the OSI Connection-mode network service for CCITT applications". (see also ISO 8878)
- [59] CCITT X.214: "Transport Service Definition for Open System Interconnection (OSI) for CCITT Applications". (see also ISO 8072)
- [60] CCITT X.224: "Transport Protocol Specification for Open System Interconnection (OSI) for CCITT Applications". (see also ISO 8073)
- [61] CCITT X.215 (1988): "Session Service Definition for Open System Interconnection (OSI) for CCITT Applications". (see also ISO 8326 and ISO 8326-AD2)
- [62] CCITT X.225 (1988): "Session Protocol Specification for Open System Interconnection (OSI) for CCITT Applications". (see also ISO 8327 and ISO 8327-AD2)
- [63] CCITT X.216 (1988): "Presentation Service Definition for Open System Interconnection (ISO) for CCITT Applications". (see also ISO 8822)
- [64] CCITT X.226 (1988): "Presentation Protocol Specification for Open System Interconnection (OSI) for CCITT Applications". (see also ISO 8823)
- [65] CCITT X.217 (1988): "Association Control Service Definition for OSI for CCITT Applications". (see also ISO 8649-2)
- [66] CCITT X.227 (1988): "Association Control Protocol Specification for OSI for CCITT Applications". (see also ISO 8650-2)
- [67] CCITT X.219 (1988): "Remote Operations: Model, Notation and Service Definition". (see also ISO 9072-1)
- [68] CCITT X.229 (1988): "Remote Operations: Protocol Specification". (see also ISO 9072-2)
- [69] CCITT X.290 (1988): "OSI Conformance Testing Methodology and Framework for Protocol Recommendations for CCITT Applications".
- [70] ISO 7776: "Information processing systems - Data communication - High-level data link control procedures - Description of the X.25 LAPB-compatible DTE data link procedures.
- [71] ISO 8208: "information processing systems - Data communications - X.25 Packet Level Protocol for Data Terminal Equipment.
- [72] ISO 8878: "Information technology - Telecommunications and information exchange between systems - Use of X.25 to provide the OSI Connection-mode Network Service.
- [73] CCITT X.612 (1992): "Information Technology - Provision of the OSI Connection-mode Network Service by Packet-mode Terminal Equipment Connected to an Integrated Services Digital Network (ISDN)". (See also ISO/IEC 9574).
- [74] ISO 8473: "Information Processing Systems - Local area networks - Protocol for providing the connectionless-mode network service.
- [75] ISO 8802-2: "Information Processing Systems - Local area networks -Part 2 - Logical link control.
- [76] ISO 8802-3: "Information Processing Systems - Local area networks -Part 3 - Carrier sense multiple access with collision detection - Access method and physical layer specifications.

2.2 Informative references

- [100] NMF GB910. NMF Telecom Operations Map (Evaluation Release Version 1.1 April 1999).
- [101] 3G TS 32.102 "Telecom Management Architecture"

3 Definitions and abbreviations

3.1 Definitions

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

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

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

Element Management Functions: for management of network elements on an individual basis. These are basically the same functions as supported by the corresponding local terminals.

Sub-Network Management Functions: that are related to a network model for a set of network elements constituting a clearly defined sub-network, which may include relations between the network elements. This model enables additional functions on the sub-network level (typically in the areas of network topology presentation, alarm correlation, service impact analysis and circuit provisioning).

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).

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

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

Network Element (NE): 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.

Resource Model: A protocol independent model describing managed objects representing network resources, e.g. an RNC or NodeB.

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

3.3 Abbreviations

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

CEIR	Common Equipment Identification Register
CPE	Customer Premises Equipment
IRP	Integration Reference Point
MMI	Man-Machine Interface
QoS	Quality of Service
SLA	Service Level Agreement
TM	Telecom Management
TMF	TeleManagement Forum
TMN	Telecommunications Management Network
TOM	Telecom Operations Map
UMTS	Universal Mobile Telecommunication System
VHE	Virtual Home Environment

4 General

4.1 UMTS

4.1.1 Requirements

The requirements and decomposition of Telecom Management for UMTS do not differ radically from that of 2G systems. The following requirements have been identified:

- to be capable of managing equipment supplied by different vendors including the management systems themselves.
- to minimise the complexity of UMTS management.
- to provide the communication between UMTS Network Elements and UMTS Operations Systems or between UMTS Operations Systems themselves via standardised interfaces (e.g. Q3, CORBA, SNMP, etc.) as appropriate and necessary.
- to minimise the costs of managing a UMTS network such that it is a small component of the overall operating cost.
- to provide UMTS configuration capabilities that are flexible enough to allow rapid deployment of services.
- to provide integrated Fault Management capabilities.
- to simplify maintenance interventions by supporting remote maintenance operations.
- to allow interoperability between Network Operators/Service Providers for the exchange of management/charging information. This includes interoperability with other networks and services (e.g. ISDN/B-ISDN, PSTN, and UPT) as well as other UMTS networks.
- to enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and grow as needed, both in size and complexity.
- to re-use existing relevant standards (e.g. GSM, IN, ISDN/B-ISDN, ITU-T, TMF etc.) where applicable
- to support the security management of UMTS (e.g. key management, access control management, operation and administration of security mechanisms) with particular emphasis on new features such as automatic roaming and packet switched services.
- to provide and support a flexible billing and accounting administration, to support charging across UMTS and non-UMTS systems.

- to address the management and assessment of system performance and operation through the use of common measurements, etc. This would enable a Network Operator/Service Provider to assess actual performance against planned targets.
- to expose any information only once.
(Example: In case an operator would like to change one parameter in a cell: Then all occurrences of this parameter, e.g. transceiver frequency, hand-over relationships, performance measurements, frequency hopping control, etc., should be changed by one action only.)
- to support the restoration of a UMTS Operations System (e.g. resynchronisation and atomic transactions).
- to have one name convention for network resources under management in the 3GPP context. To perform network management tasks, co-operating applications require identical interpretation of names assigned to network resources under management. Such names are required to be unambiguous as well.

It is acknowledged that the introduction of new architecture to support new services or the introduction of new services themselves may impact the detailed requirements of some or all of the above.

4.1.2 UMTS Reference Model

A Universal Mobile Telecommunications System is made of the following components:

- 1 or more Access Networks, using different types of access techniques (GSM, UTRA, DECT, PSTN, ISDN,...) of which at least one is UTRA;
- 1 or more Core Networks;
- 1 or more Intelligent Node Networks service logic and mobility management, (IN, GSM...);
- 1 or more transmission networks (PDH, SDH etc) in various topologies (point-to-point, ring, and point-to-multi-point...) and physical means (radio, fibre, and copper...).

The UMTS components have signalling mechanisms among them (V5, A, DSS1, INAP, MAP, #7, RSVP,...).

From the service perspective, the UMTS is defined to offer:

- Service support transparent to the location, access technique and core network, within the bearer capabilities available in one particular case;
- User to terminal and user to network interface (MMI) irrespective of the entities supporting the services required (VHE);
- Multimedia capabilities.

4.1.3 UMTS Provisioning Entities

The specification 22.101 "Service Aspects; Services Principles" [2] identifies two major entities which cover the set of UMTS functionality's involved in the provision of the UMTS services to the user. These are:

Home Environment: This entity holds the functionality's that enable a user to obtain UMTS services in a consistent manner regardless of the user's location or the terminal used;

Serving Network: This entity provides the user with access to the services of the Home Environment.

4.1.4 UMTS Management Infrastructure

Every UMTS Organisation has it's own Management Infrastructure. Each Management Infrastructure will contain different functionality depending on the role played and the equipment used by that UMTS Entity.

However the core management architecture of the UMTS Organisation is very similar. Every UMTS Organisation:

- provides services to it's customers;

- needs an infrastructure to fulfil them (advertise, ordering, creation, provisioning, ...);
- assures them (Operation, Quality of Service, Trouble Reporting and Fixing, ...);
- bills them (Rating, Discounting, ...).

Not every UMTS Organisation will implement the complete Management Architecture and related Processes. Some processes may be missing dependent on the role a particular UMTS Organisation is embodying. Processes not implemented by a particular UMTS Organisation are accessed via interconnections to other UMTS organisations, which have implemented these processes (called X-interfaces in the ITU-T TMN architecture).

The Management architecture itself does not distinguish between external and internal interfaces.

4.2 ITU-T TMN

ITU-T TMN (Telecommunications Management Network standard from the International Telecommunications Union), as defined in [1], provides:

- an architecture, made of OS (Operations Systems) and NEs (Network Elements), and the interfaces between them (Q3, within one Operator Domain and X, between different Operators);
- the methodology to define those interfaces;
- other architectural tools such as LLA (Logical Layered Architecture) that help to further refine and define the Management Architecture of a given management area;
- a number of generic and/or common management functions to be specialised/applied to various and specific ITU-T TMN interfaces.

The UMTS Management Architecture is based on ITU-T TMN, and will reuse those functions, methods and interfaces already defined (or being defined) that are suitable to the management needs of UMTS. However, the UMTS Management needs to explore the incorporation of other concepts (other management paradigms widely accepted and deployed) since:

- UMTS incorporates other technologies to which ITU-T TMN is not applied fully;
- UMTS faces new challenges that ITU-T TMN does not address today;

The ITU-T standards are mainly concentrated in the element management and network management layers. They have been developed from the bottom up, making it difficult to apply the standards as part of a business case. It is also difficult to have a customer centric focus.

An example of another management paradigm that will be employed to try and address these difficulties is the Telecom Operations Map from TeleManagement Forum (TMF). The Telecom Operations Map, using the TMN model as a foundation, addresses operation support and management for any communications service from a top down customer oriented standpoint.

It must be noted that these concerns are applicable to other telecommunication areas as well as to UMTS, it is expected that the eventual evolution of ITU-T TMN will cover this ground. Indeed, most of the above concepts are already being taken into account by ITU-T TMN evolution (protocols and methodologies).

5 Architectural Framework

5.1 UMTS Management Reference Model & Interfaces

Figure 1 illustrates the UMTS Management Reference Model. It shows the UMTS Operation System interfacing with other systems.

This specification (and the rest of the 3GPP UMTS Management detailed specifications) addresses the UMTS Operations System (function and architecture wise) and the interfaces to the other systems (information and protocol wise).

This specification does not address the definition of any of the systems which the UMTS Operations System may interface to. The rest of the 3GPP specifications regarding UMTS Management will not cover them either.

It is not the approach (nor it is possible) to re-define the complete management of all the technologies that might be used in the provision of UMTS. However, it is the intention to identify and define what will be needed from the perspective of UMTS management.

A number of management interfaces in a UMTS network are identified in figure 1, namely:

- ① between the NEs and the Operations System of a single UMTS Organisation
 - a) network element to element management level
 - b) element management to network management level
- ② between the Operations System and the Enterprise Systems of a single UMTS Organisation.
- ③ between Operations Systems of different UMTS Organisations
- ④ within the Operations System of a single UMTS Organisation

This specification will focus on management interfaces of type 1 from the above list, while interfaces of types 2 & 3 will be identified in this document, detailed specification of these interfaces is FFS. Interfaces of type 4 are beyond the scope of standardisation.

NOTE: Both TeleManagement Forum and ITU-T are carrying out work with interfaces of type 3.

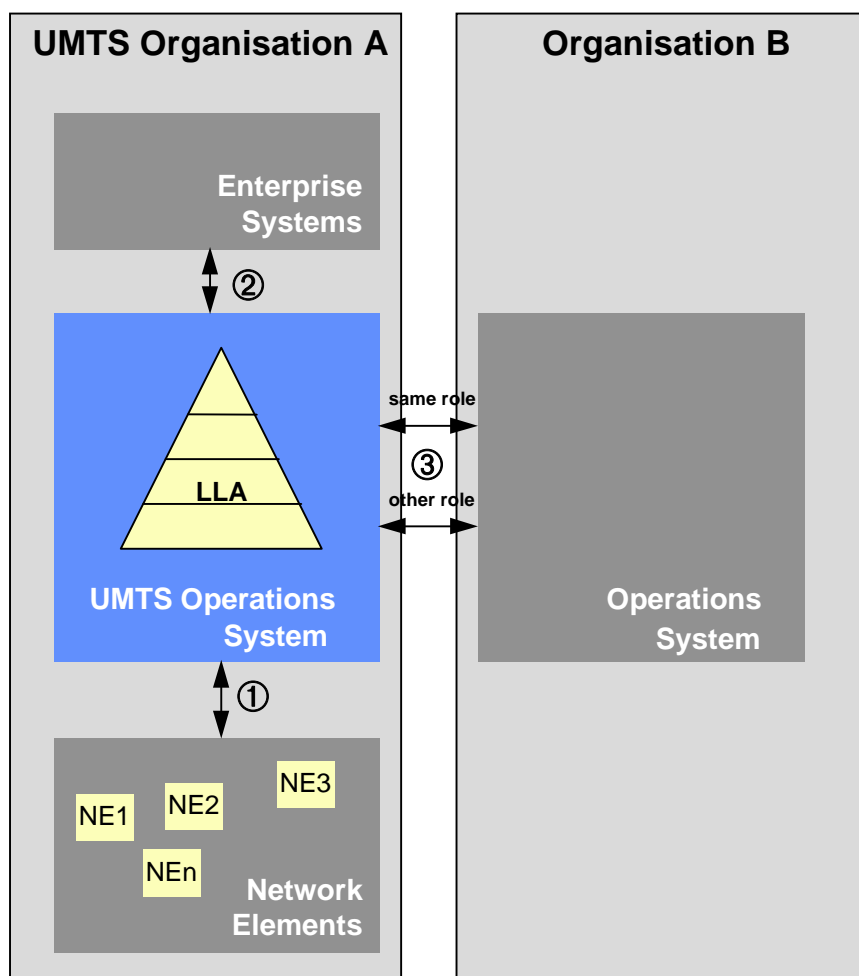


Figure 1: UMTS Management System Interactions

5.2 Interfaces to Enterprise Systems (Type ②)

It is the approach to define a UMTS Management that fully fits into the enterprise processes needs of the UMTS Organisations. One of the essential issues of today's way of running telecommunications businesses is integral operation (e.g.: customer care, from service subscription to billing, from order fulfilment to complaint management).

Enterprise Systems are 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).

Standardising Enterprise Systems is out of the scope of 3GPP work, since it involves many operator choices (organisational, etc) and even regulatory. Also Enterprise Systems are often viewed as a competitive tool. However, it is essential that the requirements of such systems are taken into account and interfaces to the UMTS Operations Systems are defined, to allow for easy interconnection and functional support.

5.3 Interfaces to NEs (Type ①)

In some cases, the management interfaces to NEs have been defined bottom-up, trying to standardise the complete O&M functionality of the various NEs.

For UMTS management, a top-down approach will be followed to streamline the requirements from the perspective of UMTS Operators top priority management processes.

It is assumed that this will not fully cover the OAM functionality of all NE types in UMTS at once, therefore a part of the functionality will be phased for further work and consideration. Some proprietary solutions (local and/or remote) will be needed in the interim. The rationale of this approach is not only the best use of resources, but also to follow a pragmatic step-wise approach that takes into account the market forces (the manufacturers and operators capabilities). A further rationale is to define clear and easy to agree steps that allow Management functionality to be implemented in the same time frame as the telecom functionality in the network (i.e. to synchronise the management and network releases).

The approach for NE Management Interfaces will be to concentrate on protocol independent information models, allowing a mapping to several protocol suites. The rationale is:

- due to the convergence of Information and Telecommunication technologies in UMTS, It is required to work on a more open approach (acknowledging the market status and foreseen evolutions);
- the life-cycle of information flows is 10 to 20 years, while that of protocols is 5 to 10 years;
- developments in automatic conversion from information models to various protocols/technologies will allow a more pragmatic and open approach (e.g. UML to GDMO, UML to IDL).

However, it is the intention to at least recommend one mapping for each interface.

5.4 Interfaces to other Operations Systems (Type ③)

UMTS Management considers integrally the interaction between the Operations Systems of other legal entities for the purpose of providing UMTS services.

There are two major types of interfaces to other management systems:

- to other UMTS Operations Systems (i.e. other from other UMTS operators);
- to other Operations Systems (i.e. to non UMTS operators).

The first type deals with co-operation to provide UMTS services across a number of UMTS networks (e.g. roaming related interactions). The second type deals with client-server relationship to other operators (e.g. to leased lines providers, to added value service providers etc).

The approach that will be followed is to identify and define integral processes, not taking into account in the first step, how many operators or operations systems might be involved, but rather concentrating on the interactions between them (i.e. assuming a UMTS operator encompasses all functionality's). A further step will be to consider and define extra requirements (security, confidentiality etc) when part of the process involves interactions with other operators operations systems.

5.5 Interface Definition

The Management interfaces are studied here from four different perspectives or levels:

- logical (information model and flows used in the relationship manager-agent, or equivalent);
- application protocol (end to end, upper layers protocol running between manager-agent, or equivalent);
- networking protocol (lower layer protocols carrying the information in/out the manager and agent, or equivalents);
- physical (mapping of the manager and agent, or equivalents, roles into physical entities).

The figure below shows the management interfaces of one part of the UMTS (The Radio Network), by way of illustration of interfaces of types 1a and 1b).

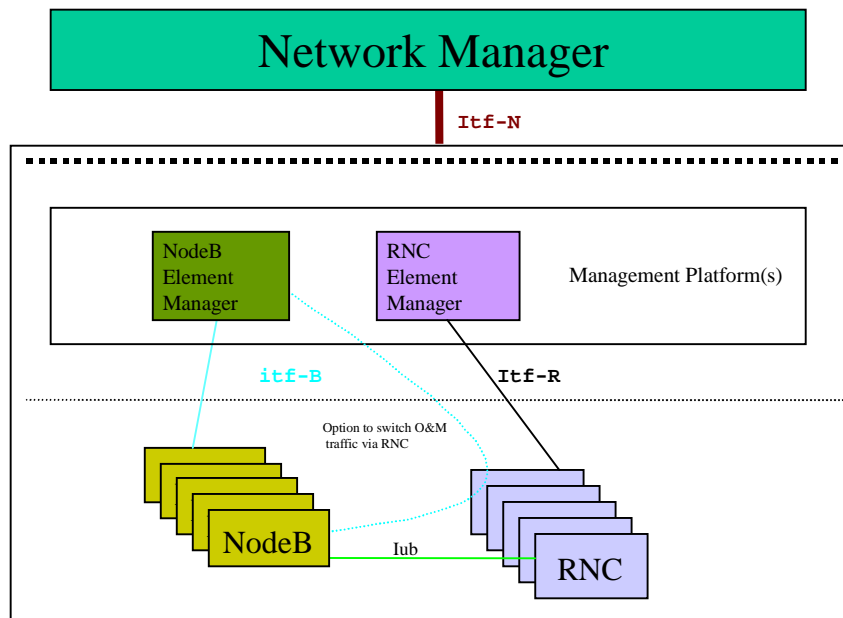


Figure 1.1: Radio Network Management Interfaces

The figure identifies the following Management Interfaces:

- Itf-B - between Node B & its Manager (physically, this may be a direct connection or via the RNC) (type 1a)
- Itf-R - between RNC & its Manager (type 1a)
- Itf-N – between Network & Network Manager (type 1b)

5.6 Logical Level

This level covers the mutual and conceptual knowledge of entities being connected by a given interface.

For type 1b interfaces (such as Itf-N in figure 1.1 above) interactions at this level are fully standardised by 3GPP in terms of protocol independent Resource Models (static information definition) and IRP Information Services (information flows) where available. These protocol independent Resource Models and IRP Information Services are hereafter referred to as IRP Information Models (Integration Reference Point Information Models).

For type 1a interfaces (such as Itf-B and Itf-R in figure 1.1 above) interactions at this level are not standardised in terms of information models or flows, though functional aspects will be specified.

5.7 Solution set Level

For each IRP Information Model at the logical level there will be at least one IRP Solution Set defined. An IRP Solution Set is a mapping of the IRP Information Service to one of several technologies (for a full definition please refer to the definitions clause of the present document).

See Annex C for the valid UMTS Management IRP Solution Sets.

5.8 Application Protocol Level

This level covers the set of primitives used to pass information across a given interface and the means to establish associations between the application entities (including the related addressing aspects) across a given interface.

Generally, the Application Protocol Suite used for the interaction between entities across a given interface is optional within the valid UMTS Management Application Protocol Suites (see Annex A for a list of UMTS Management Protocol Suites). However, in the case of interfaces of type 1b (such as Itf-N in figure 12 above) at least one of those protocol suites will be chosen as the standard protocol suite.

It is the intention to consider following attributes of each application protocol in making this decision:

CMIP :

- Very flexible;
- Powerful information modelling capability, therefore, in turn, complex to implement;
- Complex to integrate managers (specifically if CMIP stacks from different vendors are used in the agents and manager(s));
- Process hungry;
- Heavyweight stack (e.g. prevents it from being implemented on NodeB);
- Potential reuse of GSM and ITU-T standards and implementation;
- High on Cost Of Goods.

SNMP:

- is well used in other Telecom areas (e.g. ATM management);
- has inadequacies for Configuration Management (relatively simple/poor information modelling capability for management MIBs make implementation of complex information models difficult, although not impossible);
- supports auto-discovery of elements on the management network via MIB-II;
- has lower Cost Of Goods;
- more choice of “off the shelf commercial systems and software” section 7.2 ref. [101].

CORBA-IIOP:

- very powerful and flexible
- low Cost Of Goods

- not proven in Telecom Management (but gaining acceptance)

5.9 Networking Protocol Level

Whatever standardised protocol suite at the networking level that is capable of meeting the functional and operational requirements (including the network addressing aspects) of the Logical and Application Protocol levels of a given UMTS management interface, is a valid Networking Protocol for that interface.

A number of requirements shall be met by the Networking Protocol, as follows:

- capability to run over any bearer (leased lines, X.25, ATM, Frame Relay, ...);
- support of existing transport protocols and their applications, such as OSI, TCP/IP family, etc;
- widely available, cheap and reliable.

The Internet Protocol (IP) is a Networking Protocol that ideally supports these requirements. IP also adds flexibility to how management connectivity is achieved when networks are rolled out, by offering various implementation choices. For instance, these may take the form of:

- Dedicated management intranets.
- Separation from or integration into an operator's enterprise network.
- Utilisation, in one way or another, of capacities of the public Internet and its applications or other resources.

5.10 Physical Level

Though the interaction at the logical level takes place between the UMTS Management System and the UMTS NEs, it is left to the implementers choice the possibility to use the Q-Adapter¹ concept of ITU-T TMN Architecture as physical implementation (as defined in [1]).

The present document does not preclude the usage of Q-Adapters at other interfaces of the UMTS Management.

5.11 Compliance Conditions

For a UMTS entity (Management System or NE) to be compliant to a given UMTS Management Interface, all the following conditions must be satisfied:

- it implements the management functionality following the Information Model and flows specified by the relevant 3GPP UMTS Management Interface Specifications applicable to that interface;
- it provides at least one of the IRP Solution Sets (where available) related to the valid Application Protocols specified by 3GPP UMTS Application Protocols for that interface (see Annex A). For each interface at least one of the valid protocols will be recommended;
- it provides at least one standard networking protocol;
- in case the entity does not offer the management interface on its own, a Q-Adapter must be provided. This Q-Adapter must be provided independently of any other UMTS NE and/or UMTS Management System.

6 UMTS Management Processes

This document details the general aspects of a UMTS Management system. It describes primarily the management processes that collectively support Customer Care Service Development & Operations, and Network & Systems Management Processes in a UMTS network.

¹ Q-Adapter needs to be interpreted here in a wider sense than in [1], since UMTS will consider other application protocols different to CMIP

These management processes are based on the widely accepted Telecom Operations Map from the TeleManagement Forum [100]. They map onto the Service and Network Management layers as defined in the ITU-T Recommendation M.3010 appendix II [1] as depicted in Fig.2 below.

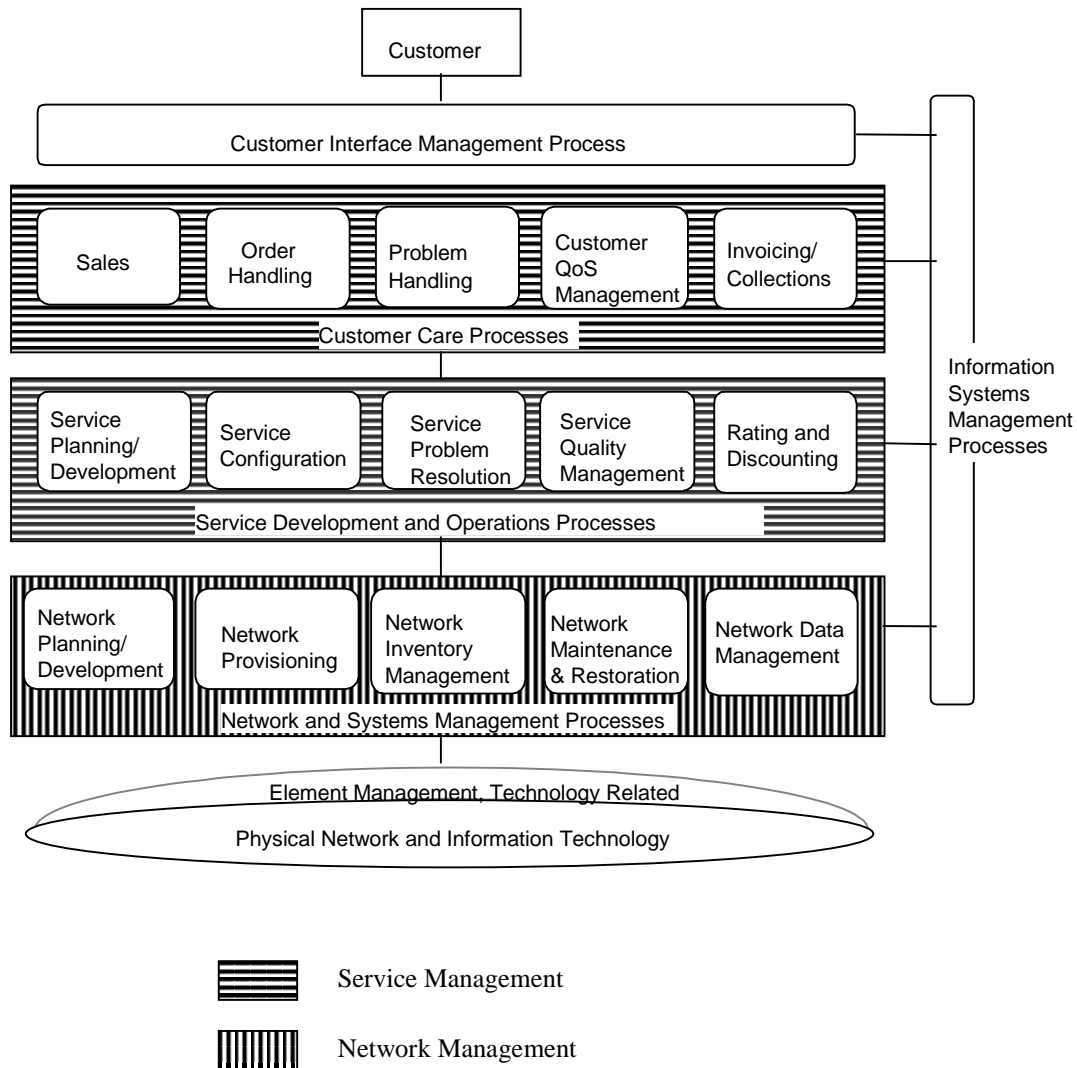


Figure 2: Telecom Operations Map Business Process Model (* imported from [100])
(Service & Network Management shading added in this document)

This Technical Specification will detail the UMTS Management Functional Architecture. This will be done by applying each of the management functions to the UMTS management processes.

The management functions are:

- fault management;
- configuration management (including equipment inventory);
- performance management (including quality of service management);
- roaming management ;
- accounting;
- customer profile management;
- service deployment;
- fraud management;

- security management
- software management

All UMTS management processes have functions in several management areas. By identifying only those processes and interfaces relating to a certain management function, for example performance management, it is possible to take a slice through the Telecom Operations Map that details the functional architecture for performance management, this will be the approach taken by this Technical Specification.

7 Process Decompositions

This clause gives a short description of each of the UMTS management processes introduced in [100]. To see a more detailed description and process spider diagram for each process please refer to [100].

7.1 Customer Interface Management

The Customer Interface Management Process directly interacts with customers and translates customer requests and inquiries into appropriate "events" such as, the creation of an order or trouble ticket or the adjustment of a bill.

7.2 Sales

The Sales Process encompasses learning about the needs of each customer, and educating the customer about the communications services that are available to meet those needs.

7.3 Ordering

The Ordering Process includes all the functions of accepting a customer's order for service, tracking the progress of the order, and notifying the customer when the order is complete.

7.4 Problem Handling

The Problem Handling Process is responsible to receive service complaints from customers, resolve them to the customer's satisfaction and provide meaningful status on repair or restoration activity.

7.5 Customer QoS Management

This process is concerned with UMTS Quality of Service (QoS) and its measurement, management and reporting.

7.6 Invoicing and Collection

This process encompasses sending invoices to customers, processing their payments and performing payment collections.

7.7 Service Planning and Development

This process encompasses:

- designing technical capability to meet specified market need at desired cost;
- ensuring that the service (product) can be properly installed, monitored, controlled, and billed;
- initiating appropriate process and methods modifications, as well as initiating changes to levels of operations personnel and training required;

- initiating any modifications to the underlying network or information systems to support the requirements;
- performing pre-service testing that the technical capability works and that the operational support process and systems function properly;
- ensuring that sufficient capacity is available to meet forecasted sales.

7.8 Service Configuration

This process encompasses the installation and/or configuration of service for specific customers, including the installation/configuration of customer premises equipment.

7.9 Service Problem Resolution

This process encompasses isolating the root cause of service affecting and non-service affecting failures and acting to resolve them. Typically, failures reported to this process affect multiple customers

7.10 Service Quality Management

This process supports monitoring service or product quality on a service class basis in order to determine

- whether service levels are being met consistently;
- whether there are any general problems with the service or product;
- whether the sale and use of the service is tracking to forecasts.

7.11 Rating and Discounting

This process encompasses:

- applying the correct rating rules to usage data on a customer-by-customer basis, as required;
- applying any discounts agreed to as part of the Ordering Process;
- applying promotional discounts and charges;
- applying outage credits;
- applying rebates due because service level agreements were not met;
- resolving unidentified usage.

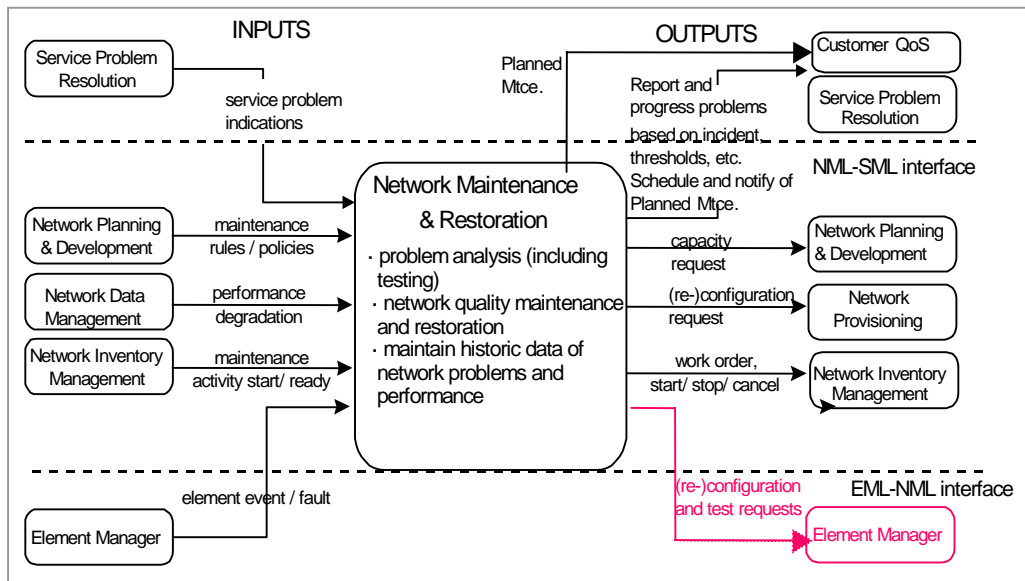
7.12 Network Data Management

In general, this process is responsible for the collection of performance/usage data and events for the purpose of network performance, usage and traffic analysis. This data is also an input to the Rating and Discounting process at the Service Management Layer.

7.13 Network Maintenance & Restoration

This process encompasses maintaining the operational quality of the network, in accordance with required network performance goals.

Note: 3GPP have added an additional process flow to this process. For this reason a modified spider diagram for this process is included below (changes highlighted in red), this change has been submitted to TMF for inclusion in the Telecom Operations Map (TOM), when the changes is incorporated in the TOM the diagram can be removed from this document.



NOTE: Red colours in the figure above indicate changes to Telecom Operations Map not yet approved by TMF.

Figure 3: Network Maintenance and Restoration Process

7.14 Network Inventory Management

This process encompasses anything to do with physical equipment and the administration of this equipment.

7.15 Network Provisioning

This process encompasses the configuration of the network, to ensure that network capacity is ready for provisioning of services.

7.16 Network Planning and Development

This process encompasses development and acceptance of strategy, description of standard network configurations for operational use, definition of rules for network planning, installation and maintenance.

8 UMTS Management Functional Architecture

8.1 TM Architectural aspects

The basic aspects of a TM architecture, which can be, considered when planning and designing a TM are

- the functional architecture;
- the information architecture;
- the physical architecture.

The management requirements from the business needs will be the base for the functional architecture, which will describe the functions that have to be achieved. The information architecture defines what information that has to be provided so the functions defined in the functional architecture can be achieved. The physical architecture has to meet both the functional architecture and the information architectures. These relationships are shown in figure 4 below.

This document addresses the Functional Architecture, the Physical Architecture is addressed in [101].

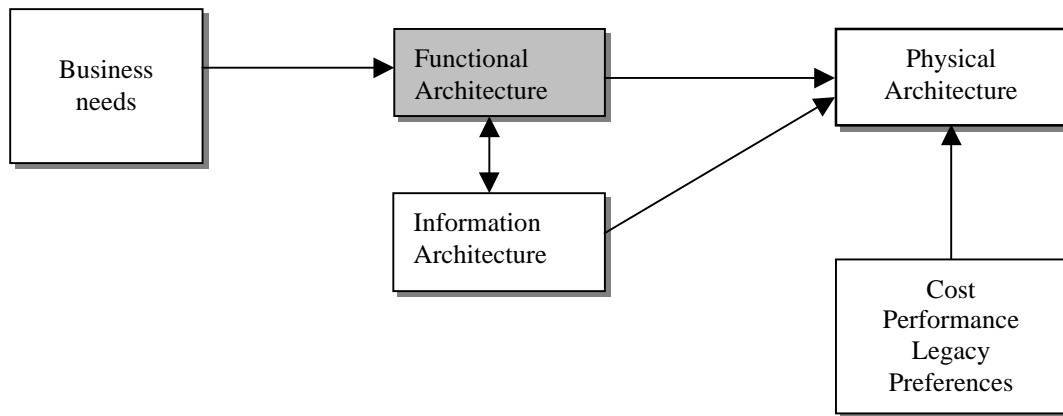


Figure 4: Architectural relationship

8.2 Performance Management

Figure 5 below makes a cut through the Telecom Operations Map from a Performance Management perspective. Although this "cut slice" is quite large it does not contain all and everything related to Performance Management. But it contains all processes and interfaces mainly involved in Performance Management. To make the figure clearer different thicknesses of lines have been used to illustrate the different importance of the accordingly marked interfaces.

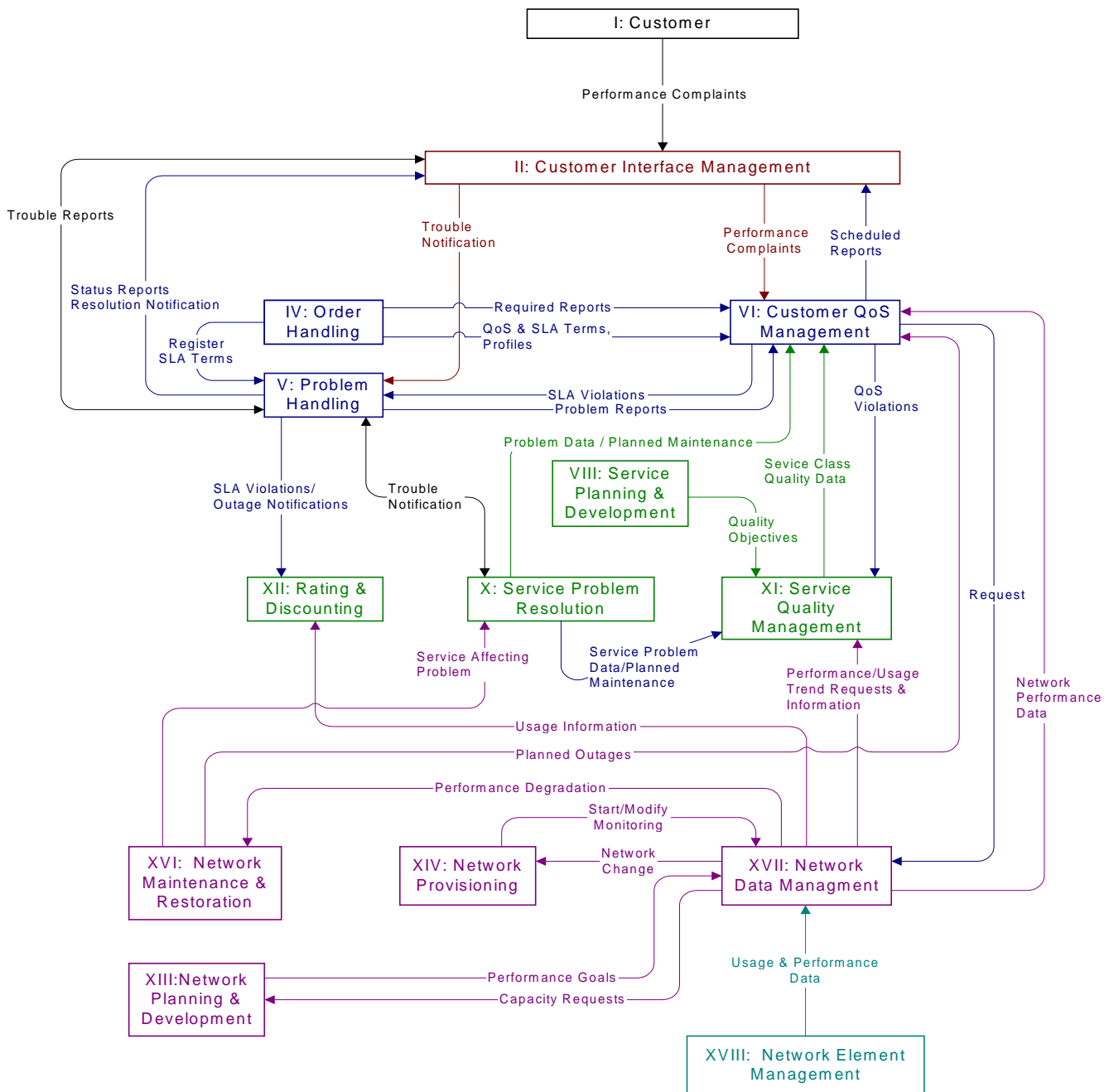


Figure 5: Information flow to support Performance Management

8.3 Roaming Management

This example describes a unique, for mobile networks, management task. Roaming is a service provided by mobile service providers where customers of a home service provider may use the infrastructure of another, a serving service provider (see figure 6). The idea is that a customer receives the same service when it roams in another network, as it would receive at home.

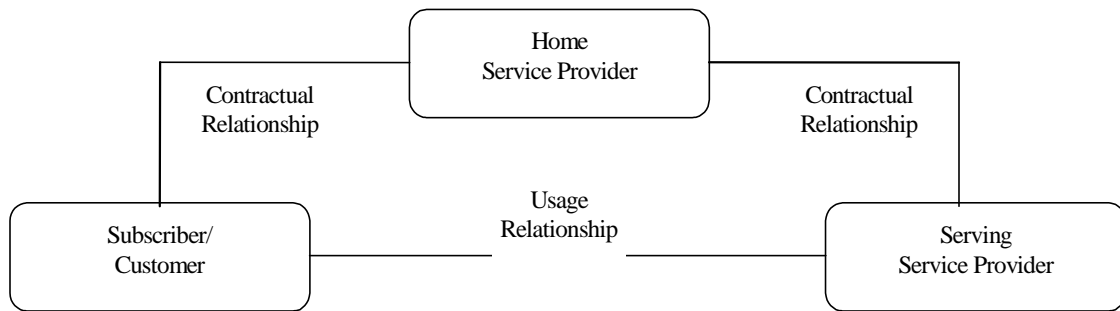


Figure 6: Relationships between Subscriber, Home and Serving Service Provider

In order to make this happen, the home service provider and serving service provider need a contractual relationship called a roaming agreement. The roaming agreement can be an ordinary direct agreement between both service providers or it can be established by the means of a clearinghouse.

In any case the roaming agreement regulates at least the following items:

- tariffing and pricing;
- signalling and traffic interconnection;
- CDR exchange format and exchange schedule;
- problem handling; and many others.

Today's mobile networks have roaming agreements with tens of other networks. With 3rd Generation mobile networks coming this number is expected to increase to hundreds if not more. All these roaming agreements have an impact on many parts of the network.

The handling of this complex process requires an excellent understanding of roaming agreement management. To aid this understanding figure 7 below is provided. All information flows, which are not effected or not changed by roaming agreement management, have been omitted to aim readability.

Note: The information flows shown in figure 7 are intended to illustrate the flow of management information required to support roaming in 3rd Generation networks.

The information flow illustrated below is an overlay onto the main information flow of a serving mobile service provider to support it's own subscribers. This overlay information flow of the serving service provider is triggered by the request to establish or update a roaming agreement issued by the customer.

In this context the home service provider is classified as a customer of a serving service provider (customer in this context does not refer to an individual customer of the home service provider!).

The home service provider (customer) would like to offer roaming to the serving service provider to its subscribers.

The roaming agreement management information flow consists of one major and two optional supporting information flows:

- customer care information flow (solid line)
This is the major information flow supporting all contract related activities: negotiating tariffs, negotiating SLAs, trouble handling, roaming accounting file exchange, ...
- new service facilities information flow (dash-dotted line)
This is an optional supporting flow which takes place if the support of an roaming agreement requires the introduction of new services or a configuration change of existing services.
- new network facilities information flow (dashed line)
This is an optional supporting flow which takes place if the support of an roaming agreement requires the introduction of new network facilities or a configuration change of existing network facilities.

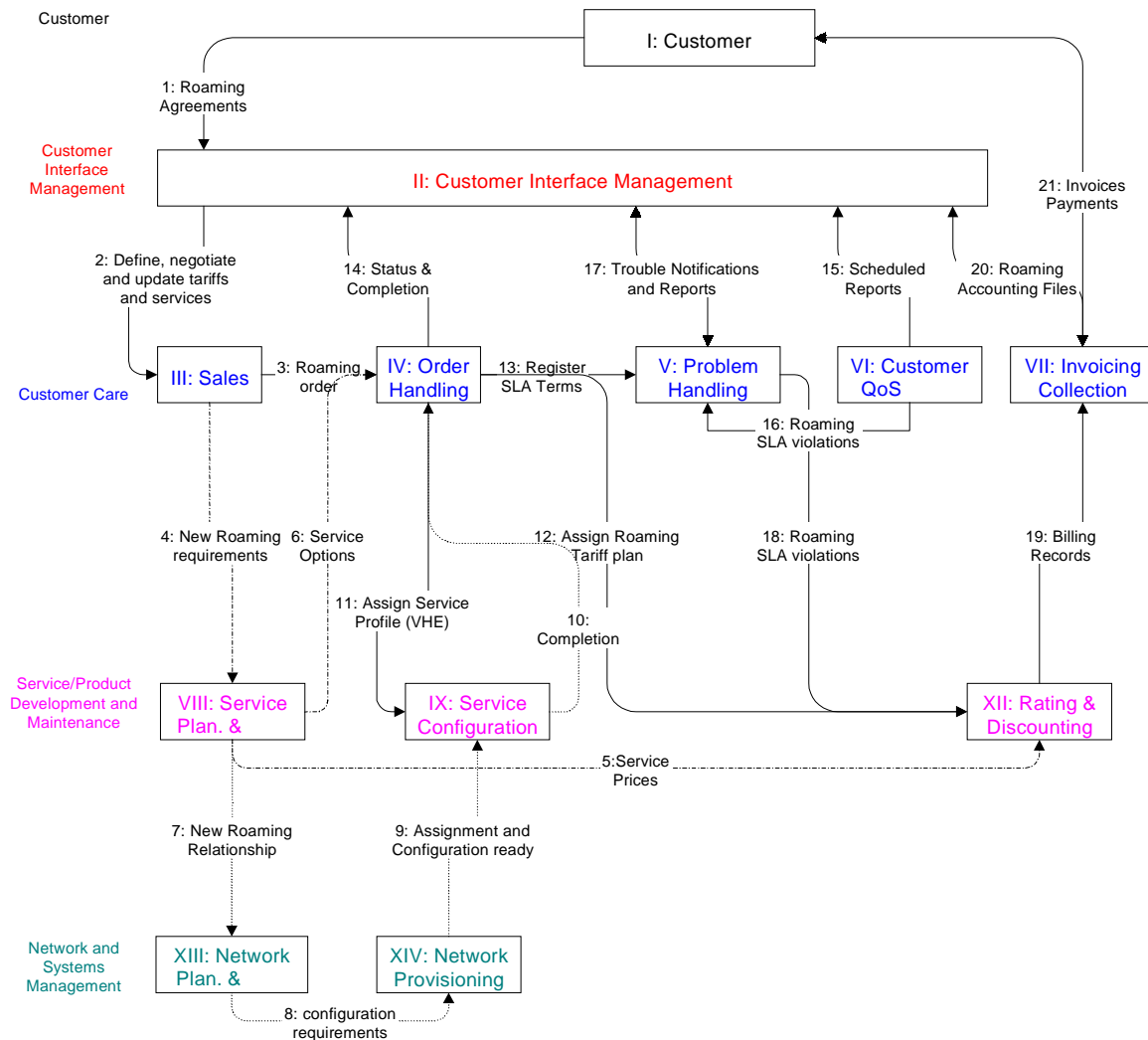


Figure 7: Information flow to support Roaming Management

8.4 Fraud Management

Fraud and all the activities to detect and prevent fraud are quite common for most of the networks. Nonetheless it should be mentioned that two mobile network specific services: mobility and roaming make fraud detection and fraud prevention even more complicated: The mobile service provider does not know where is the "end of the wire" leading to the home of a fraudulent customer. In case of roaming the situation is even worse. The fraudulent customer uses the network facilities of another – the serving - service provider which means that it is to a large extent out of control of the home service provider.

Typically fraud management in mobile networks (i.e. fraud detection and prevention) covers at least the following functions:

- classification of customers according to levels of fraud risk (based on demographic and credit information);
- revision of the fraud risk level (based on usage information, payment behaviour, ... near real time or off-line);
- detection of fraud patterns (in real time or near real time);
- taking the appropriate actions to suspend service provision, even if the customer is using a different network than its home (the customer is roaming);
- for visiting customers (i.e. those who are roaming) it may consult the home provider and/or international repositories (e.g. the Central Equipment Identity Register – CEIR for GSM mobile equipment).

Fraud management is present in several processes of the Telecom Operations Map. Figure 8 below shows the occurrence of fraud detection and fraud prevention functions listed above to the existing processes of the Telecom Operations Map.

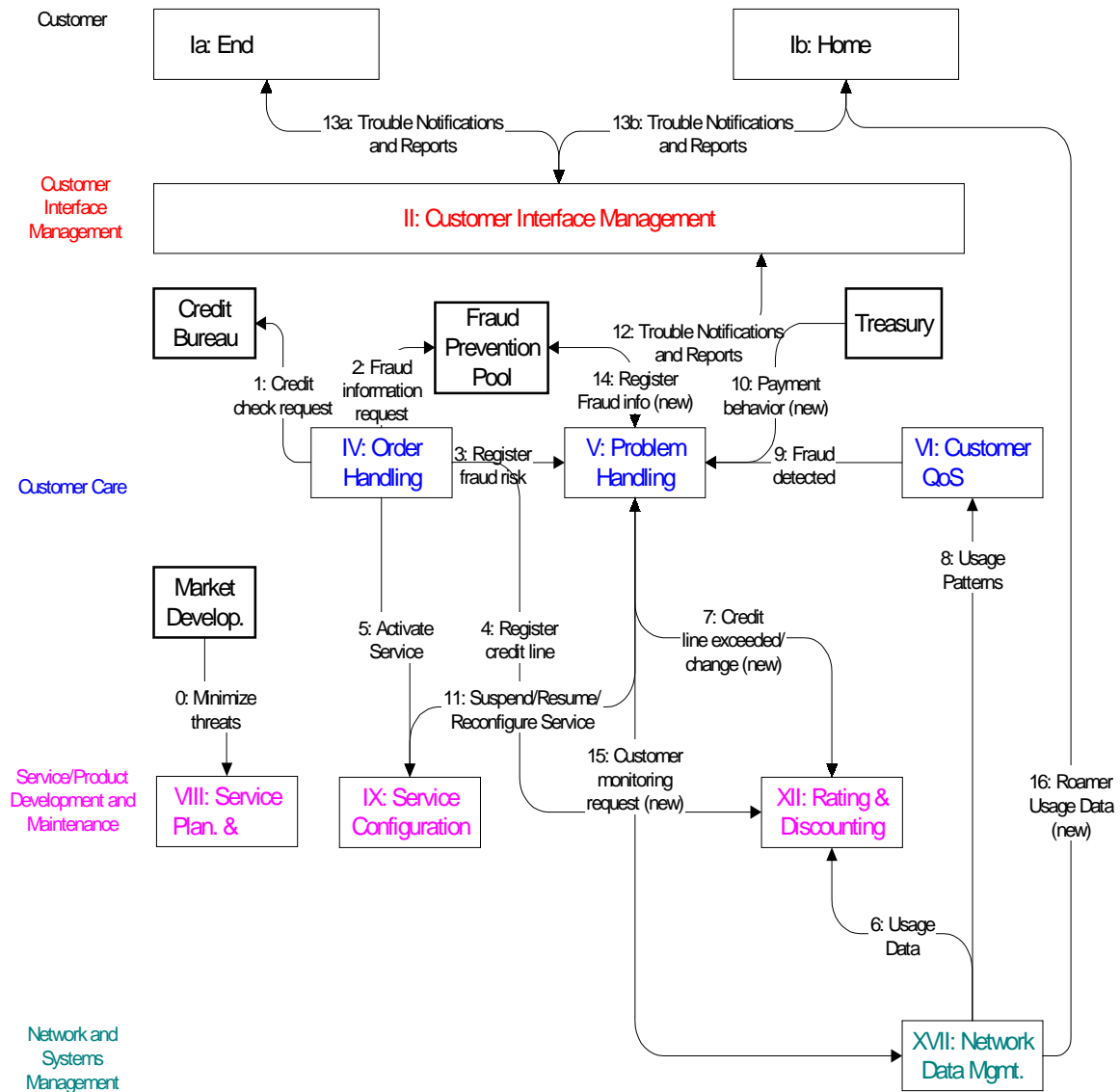


Figure 8: Information flow to support Fraud Management

Fraud management functions are present in many processes of the Telecom Operations Map. What makes fraud management so difficult is the fact that it consists of many process flows segments instead of one or two continuous process flows. This is also the reason making the presentation of fraud management in the Telecom Operations Map so difficult.

Although it seems that all required functions to support fraud management exist in the Telecom Operations Map, fraud management requires the introduction of some new interfaces (marked accordingly in figure 8) to be efficient.

- Pre service: prevent fraud
 - Potential threats and leaks should be analysed during Service Planning and Design and the service should be optimised to be as resistant to threats as possible.
- Fulfilment: prevent fraud
 - Order Handling initiates the classification of customers according to levels of fraud risk. This includes a credit check request; and
 - A retrieval of fraud information from a fraud prevention pool (if available).

- The determined initial fraud risk level will be registered at Problem Handling.
- A credit line depending on the customer's fraud risk level will be registered at Rating & Discounting.
- Finally the ordered Service will be activated fully or partly depending on the fraud risk level.
- Assurance 1: detect fraud
 - Normal usage data (preferably hot billing usage data) is transferred to Rating and Discounting.
 - Rating & Discounting checks billing records for exceeding established credit lines and reports this Problem Handling (new).
- Assurance 2: detect fraud
 - Usage data/patterns are sent to the Customer QoS Management for analysis.
 - If Customer QoS Management detects a fraud then it sends an according notification to Problem handling which can decide on appropriate actions to take in order to prevent or stop fraud.
- Assurance 3: detect fraud
 - Treasury informs Problem handling about the payment behaviour of customers.
- Assurance 4: stop fraud
 - Problem Handling can decide on appropriate actions to take in order to prevent or stop fraud by reconfiguring the service; and/or
 - contacting via Customer Interface Management
 - The Customer (either the end-customer or the home service provider in case of a visiting customer).
- Assurance 5: prevent fraud
 - Problem handling may register fraud information in the Fraud Prevention Pool.
- Assurance 6: stop roaming fraud
 - Problem handling requests the monitoring of a visiting customer on a trouble notification request of its home service provider according to the roaming agreement.
 - Network Data Management delivers the usage data to the requesting home service provider.

8.5 Fault Management

Fault Management is accomplished by means of several Processes/Sub-processes like fault detection, fault localisation, fault reporting, fault correction, fault repair, etc... These Processes/Sub-processes are located over different management layers, however, most of them (like fault detection, fault correction, fault localisation and fault correction) are mainly located over the Network Element and Network Element Management layers, since this underlying network infrastructure has the 'self healing' capabilities.

It is possible, however, that some faults/problems affecting the telecom services are detected within the "Network and Systems Management" layer, by correlating the alarm/events (originated by different Network Elements) and correlating network data, through network data management.

Network data management logically collects and processes both performance and traffic data as well as usage data.

While the fault management triggered within the Network Element and NE Management layers is primarily reactive, the fault management triggered within the Network and Systems Management layer is primarily proactive, meaning triggered by automation rather than triggered by the customer, and this is important for improving service quality, customer perception of service and for lowering costs.

Focusing on the Network and Systems Management layer, when a fault/problem is detected, no matter where and how, several processes are implicated, as described in figure 9 below.

8.5.1 Telecom Operations Map.

The diagram below taken from the Telecom Operations Map [100] shows an example of how fault management data can be used to drive an operators service assurance process. Service assurance then becomes primarily proactive, i.e. triggered by automation rather than triggered by the customer. It is argued that this approach is key to improving service quality, customer perception of service and for lowering costs.

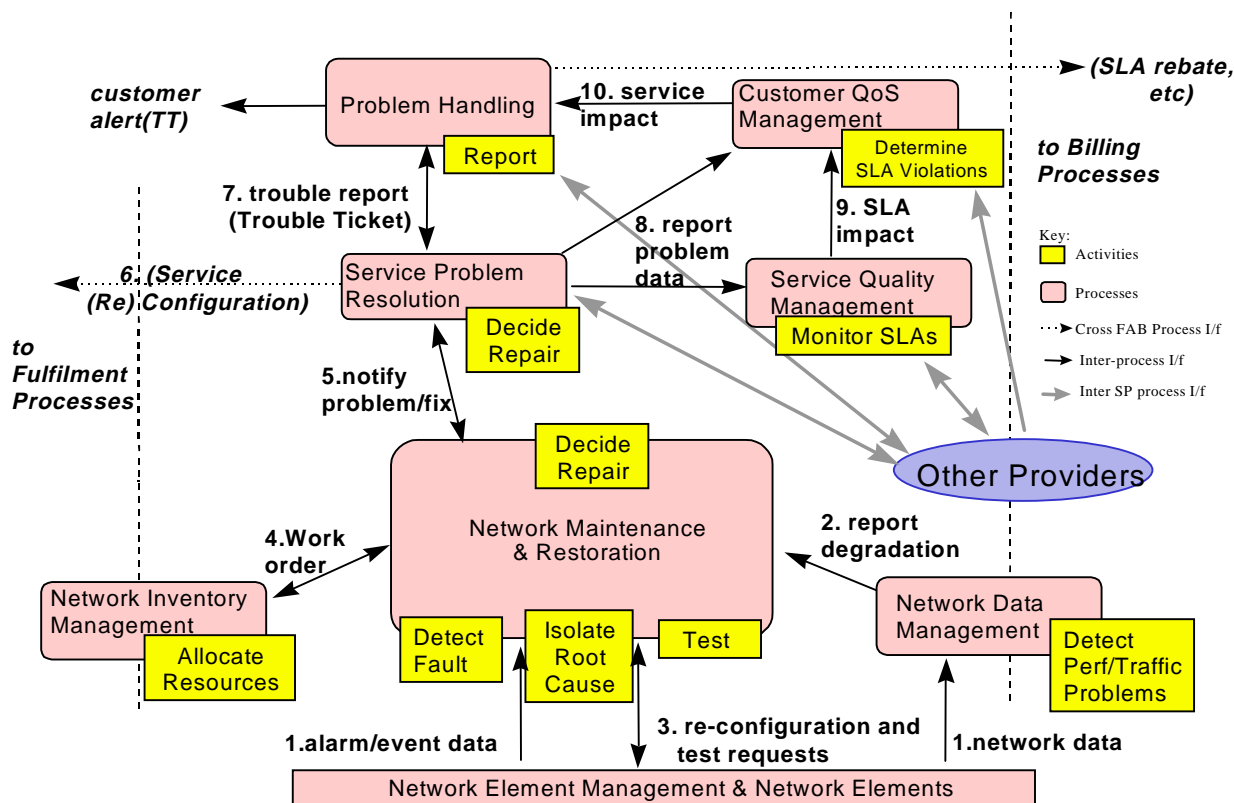


Figure 9: Service Assurance Process Flow (* imported from [100])

TOM assurance activities (and their associated interfaces) shown in figure 9 above can be associated with ITU-T TMN service components from [3] according to the following table:

ITU-T TMN Service Component [3]	TOM Network Management Assurance Activities
Alarm Surveillance	Detect Fault
Fault Localisation	Isolate Root Cause
Fault Correction	Decide Repair / Allocate Resources
Testing	Test

The TOM assurance example shown in figure 8 also recognises that Performance Management data can also be used to detect network problems.

The TOM assurance example also adds some detail to the Service Management Layer by showing how activities such as determining and monitoring SLA's (Service Level Agreements) and trouble ticket reporting are interfaced to the Network Management layer.

8.5.1 General Requirements, Service Components and Functions

Fault Management service components and functions are an area well documented by existing ITU-T, ETSI and other standards. The GSM Specification GSM 12.11 (Fault Management of the Base Station System) provides a comprehensive explanation and specification of the relevant ITU-T TMN standards. This has been used as a basis for the 3G specification 3G TS 32.111.

3G TS 32.111 is based on the following service components: -

- alarm surveillance;
- fault localisation;
- fault correction;
- testing.

Please refer to [3] for complete details.

8.6 Security Management

This section describes an architecture for security management of the TMN that is divided into two layers, as shown in Figure 10. No individual layer is dependent on any specific technology in the other one.

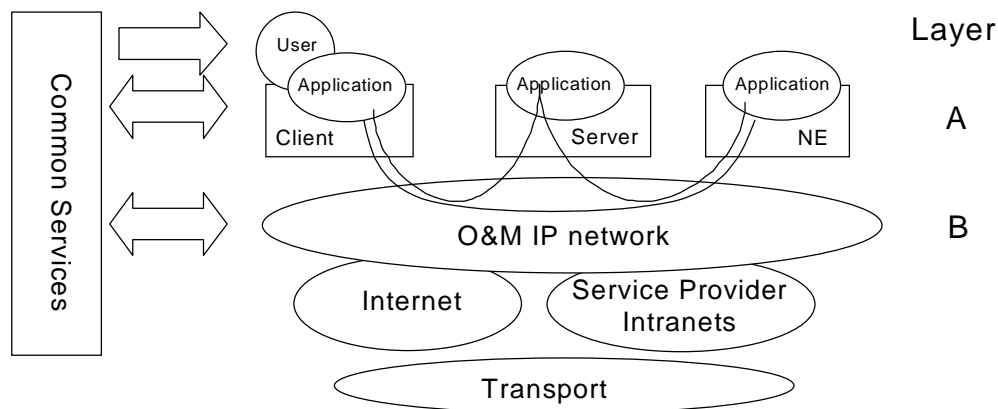


Figure 10 Security Management Architecture

8.6.1 Layer B - O&M IP Network:

Some Service Providers might build their O&M IP network as a completely private, trusted network. In the normal case though, the O&M IP network should be regarded as partly insecure due to its size, complexity, limited physical security and possible remote access from dial-up connections or from the Internet. The only security service provided then is that the O&M IP network is logically separated from the Internet. IP infrastructure aspects on security are handled to the extent possible utilizing IP classic features (addressing schemes, DNS, DHCP, BOOTP, protection with firewalls etc.).

Additionally, a trusted IP-environment to the application level might be provided, e.g. an environment with no masquerading IP-hosts and where potential intruders can not communicate. One way to accomplish such a secure DCN is to use IP security mechanisms (IPSec, see [25]) to achieve authentication of IP hosts (servers, gateways, network elements) and optional encryption of O&M traffic. Note however that the secure DCN does not authenticate users.

8.6.2 Layer A - Application Layer:

On this layer we find Telecom Management applications performing their tasks in the normal management functional areas. Managed objects residing in the network resources are often accessed or manipulated.

Layer A provides authentication of users ensuring that every party involved in O&M traffic is securely authenticated against every other party. The implementation of the authentication service supports “single log-on” (a user only has to log-on once to get access to all O&M applications in the network) and “single point of administration” (an administrator only needs to maintain a user and his/her profile in one place).

Layer A also provides authorization (access control) - to verify if a user is authorized to perform a certain operation upon a specified target object at a given time. In addition, it addresses the use of signing and logging of events. Logging

of events here means "logging of actions" (not necessarily logging of ALL actions) to be able to check "who did what". At least all "critical" actions (configurations etc.) shall be logged.

Interface definitions addressing authentication and authorization are needed. Also note that layer A requires confidentiality. Layer B may provide this service. If not, layer A instead has to provide it itself.

8.6.3 Common Services

In common services we find the security infrastructure components:

- Directory (for storage of user information, certificates, etc.);
- PKI (Certificate Authority, Registration Authority, Public Key Certificate, etc.).

Layer A relies on, and interacts with, the Common Services through distribution of certificates and keys, authentication of users, authorization, utilities for security administration (setting access rights), etc.

Note that layer B does not necessarily interact with Common Services for security management purposes. The arrows in Figure 10 simply indicate the possible use of common services for configuration management.

8.7 Software Management

This subclause describes the software management process for third generation networks. Two main scenarios are considered:

- Main SW Management Process : It covers requesting, acceptance, installation, monitoring, documenting, data base updating and feedback to the vendor for managing software. The sub-processes are valid for complete software releases and software patches for fault correction of the network elements and even element managers.
- Software Fault Management: Its emphasis is on network monitoring and handling faults which are caused by software malfunctions.

8.7.1 Main Software Management Process

The main focus is the management of new software releases and correction patches. Importance is placed integrating new software into a network with out causing unnecessary service disruptions and maintaining high levels of quality for the network. The Software Installation process is illustrated in Fig. A.

- 1) Based on inputs form customer care interactions and marketing research, a network operator will establish new feature requirements. These requirements are sent to the vendor in the form of a feature request.
- 2) The vendor deliveries a new software release/correction with the corresponding documentation and installation procedure to the network operator. It should be noted that when a network operator utilises equipment form more than one vendor, this process must run as multiple parallel processes.
- 3) A service quality management department of the network operator receives and reviews the software. Upon approving the software for installation, the software is sent to the network provisioning department.
- 4) Installation Task
 - a) The software is installed in the appropriate network elements and/or element managers by network provisioning.
 - b) Installation information is sent to the network maintenance and restoration department to inform them of pending changes in the network.
 - c) Installation information is sent to the customer care centre to inform them of pending changes in the network.
- 5) Installation Test and Validation
 - a) Once the software has been installed, network provisioning must (should) perform test to check and ensure that the new software is working properly.

- b) In addition to the checks that are performed by network provisioning, network maintenance and restoration could also detect malfunctions with in and outside the updated network element.
 - c) Should network maintenance and restoration detect a problem with in the updated network element, then the network provisioning is informed to decide on further actions.
- 6) Successful Installation Result
- a) Upon successful installation of the software, the service quality management departments is informed.
 - b) A report is sent to network maintenance and restoration to inform them that the software will remain implemented in the network. At this point the documentation library and software data base must be updated.
 - c) The network data management department is informed over the changes in the network.
- 7) Negative Installation Result
- a) If the installation fails, network provisioning must perform a “fallback”, i.e. remove the new software and insure that the network element is running properly on the old software.
 - b) A report containing the negative results and finding will be sent to the service quality management and at the same time to the network maintenance and restoration.
- 8) Once the installation procedure has been ended, the network maintenance and restoration department must closely monitor the affected network element to ensure proper performance.
- 9) Service quality management will send feedback to the vendor as to the positive or negative results of the installation.

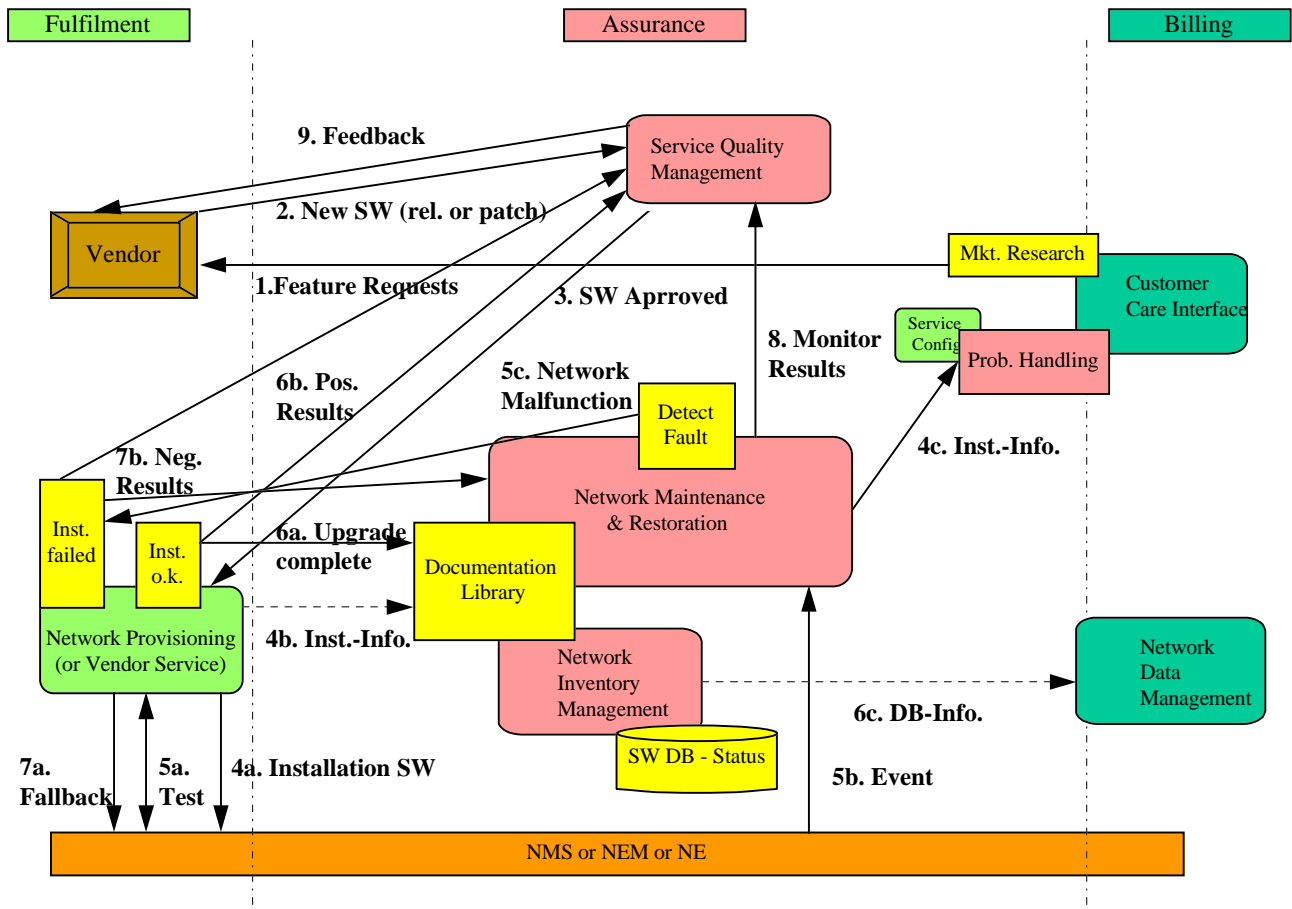


Figure 11: Main Software Management Process

8.7.2 Software Fault Management.

- 1) The network maintenance and restoration department detects an event or an alarm/fault from the network element.
- 2) Problem solving and informing customer care
 - a) The alarm is forwarded to the service problem resolution department for corrective actions and it is determined that the problem is caused by a software defect.
 - b) In parallel the Customer Care Centre is informed, if the malfunction of the network may have impact on customers.
- 3) The service problem resolution department informs problem handling and subsequently the customer care centre over service impairments with in the network.
- 4) Problem handling reports to the service quality management department. The service disturbance is described with in the report.
- 5) Service quality management checks the current software level of the affected network element with the network inventory management department.
- 6) If major network disturbances still appear the Service Quality management decides to fallback to a stable SW version (maybe some time after a new SW installation) and requests Network Provisioning.
- 7) a+b) :Network Provisioning performs the fallback and informs Network Maintenance and Inventory.
- 8) Service quality management sends a request for a software correction to the vendor.
- 9) The vendor sends a new software release or correction to the network operator. The rest of the procedure can followed in the main software management process.

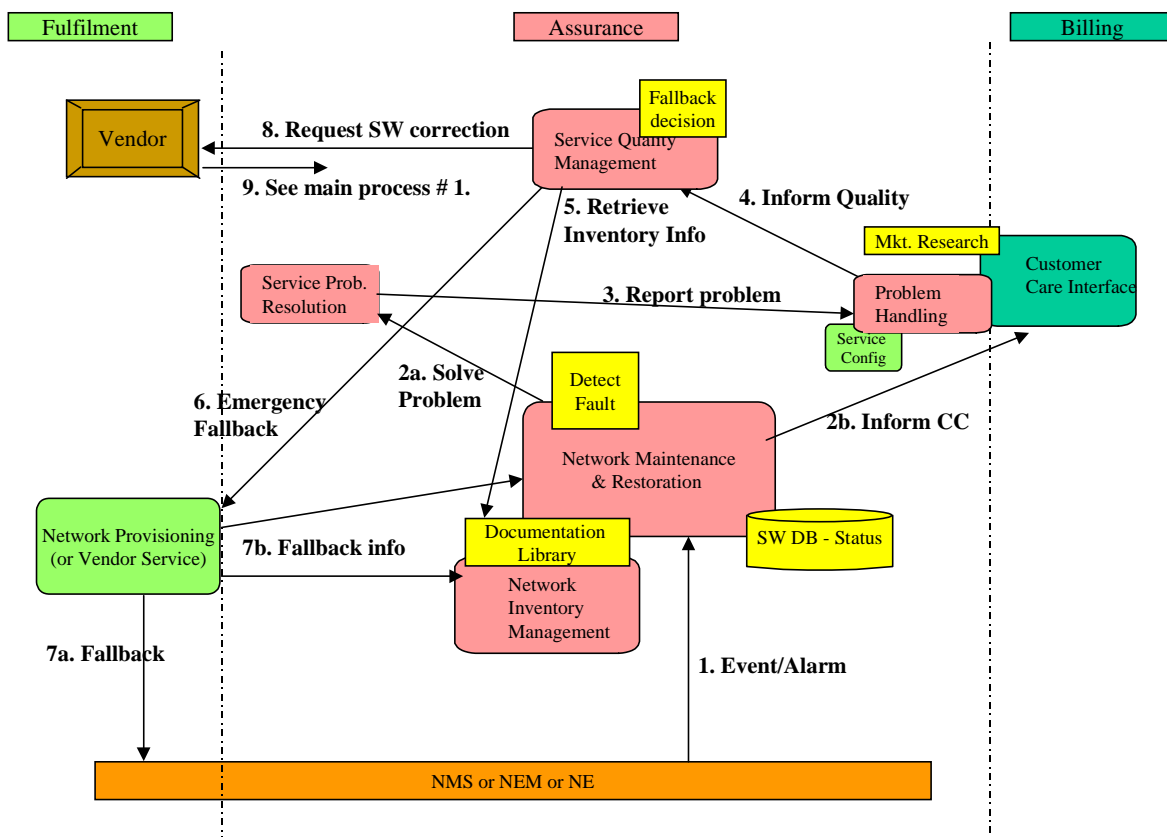


Figure 12: Software Fault Management

8.8 Configuration Management (including Equipment Inventory)

A variety of components will make up an operator's actual implementation of a 3G network. Since it is an explicit goal of the standardisation effort within 3GPP to allow mix and match of equipment from different vendors, it is expected that many networks will indeed be composed of multiple vendors' equipment. For an operator to be able to properly manage this diverse network, in order to provide the quality of service expected by his customers, it is essential to standardise the configuration management for 3G systems at least to an extent that the operation of the multi-vendor network will be possible effectively and efficiently. Therefore, a new work item is proposed for Configuration Management of 3G systems as described below. Within the scope of this work item, a distinction has to be made between those aspects of the configuration management targeting single network elements (NE management level) and those that are also, or exclusively, relevant for some part or the entire network (Network Management level).

8.9 Accounting Management

3G TS 31.105 "3G call event data" is based on the requirements specified in 3G TS 22.115. The main content of this new specification is:

- Layout and formats of raw call and event data for the 3G switching nodes (circuit and packet switched);
- Data generation dependent on call states and TS 22.115 service requirements;
- Formal description of the call and event data records in ASN.1 and definition of a file transfer mechanism (FTP).

9 Methodology

9.1 Documentation

The methodology followed for the specification of UMTS Management is structured in the following levels and steps:

9.1.1 UMTS Management Overall Architecture, Functionality/Processes and Principles specification

The UMTS Management Overall Architecture, Functionality/Processes and Principles are specified in the present document.

9.2 Tools and Methods

The tool and method to be used for documenting Interface Specifications will be UML.

Annex A (normative): UMTS Management Application Layer Protocols

The valid Management Application Layer Protocols for UMTS are:

- CMIP
- SNMP
- CORBA IIOP

The valid Application Layer Protocols for Bulk Transfer are:

- FTAM
- ftp
- tftp

Annex B (normative): UMTS Management Network Layer Protocols

The valid Network Layer Protocols for the Management of UMTS are:

- IP
- X.25

Annex C (normative): UMTS Management IRP Solution Sets

The valid IRP Solution Sets for the Management of UMTS are:

- CMIP/GDMO
- CORBA/IDL

History

Document history		
0.0.0	19/04/1999	Draft based on ETSI ES 201 385 V1.1.1 (1999-01)
1.0.0	26/04/1999	Draft as submitted to TSG SA Plenary (minor editorial work done to align styles with 3GPP style sheet, but otherwise identical to version 0.0.0)
1.1.0	06/05/1999	Draft incorporating changes agreed at TSG SA WG5 meeting 3, Helsinki on May 5 th 1999.
1.1.1	14/05/1999	Final changes agreed at Helsinki i.e.: <ul style="list-style-type: none"> • Addition of Annex B, Transport Protocols. • Clarify use of TMN term as ITU-T TMN standard where appropriate Renumbering of the specification from 32.001 to 32.101 to align with the new 3GPP specification numbering scheme.
1.1.2	10/06/99	Changes as a result of Cambridge SA5#4 meeting i.e.: <ul style="list-style-type: none"> • Addition of Editors Note to Scope section. • Removal of Editors Note and addition of FM Requirement to section 4.1.1 (Requirements) • Removal of Editors Note and addition of explanatory text to section 4.2 (ITU-TMN) • Rewording of introductory text in section 6 (UMTS Management processes) and updates to Figure 1 (Telecom Operations Map Business Process Model) based on Tdoc 95 (Siemens). • Addition of introductory text to Fault Management from Tdoc 93 (Italtel). • Updates to diagrams in sections 7.13 (Network Maintenance and Restoration) and 8.5.1 (Telecom Operations Map) from Tdoc 94 (Siemens).
1.1.3	04/08/99	Changes as a result of San Diego SA5#5 meeting i.e.: <ul style="list-style-type: none"> • Removal of text and diagrams imported directly from TMF Telecom Operations Map, replaced by reference to TOM document. • Addition of Software Management section (8.7) as per Tdoc s599138. • Addition of Configuration Management section based on the CM work item description (Tdoc s599114) Other Editorial Changes <ul style="list-style-type: none"> • Removal of editors notes from scope section. • Grammatical Rewording of section 5.3
1.2.0	14/09/99	Changes as a result of Cork SA5#6 meeting i.e.: <ul style="list-style-type: none"> • Rewriting of Chapter 9 based on Tdoc 168 with amendments as agreed in Cork and documented in the 32.101 rapporteur's report (Tdoc201). • Other amendments to the previous version (1.1.3 - Tdoc 191) as agreed in Cork and documented in the 32.101 rapporteur's report (Tdoc201).

1.3.0	10/11/99	<p>Changes as a result of Tampere SA5#7 meeting i.e.:</p> <ul style="list-style-type: none"> • Accounting Management Description added to section 8.11 • Removal of “Customer Profile Management” and “Service Deployment Management” sections • Merging of Section 9 into Section 5. • Mention of ITU-T Standards added to CMIP Section 5.7 (former 9.2) • SA5 agreed terminology for naming of Management Systems included in Definitions section and terminology adopted throughout the specification. • NE definition from 32.106 included in Definitions section. • Enterprise System definition added.
1.4.0	08/12/99	<p>Changes as a result of Bonn SA5#8 meeting i.e.:</p> <p>Note: This is the final R99 version which is to be submitted to SA for approval.</p> <ul style="list-style-type: none"> • Minor typographical changes to section 5.1 & 5.2. • Corrections to terminology of Annexes A & B, Removal of Ethernet LAN from Annex B, and spurious sentence from Annex A. • Clarification of section 4.1.2, addition of statement re Access Networks, removal of inconsistent examples of Core Networks • Addition of IRP related terminology to Definitions and Abbreviations • Clarification added to section 5.3 (Interfaces to NEs) noting the use of protocol independent information models. • Modifications to 5.6 (logical level) to include IRP Information Services and IRP Information Models • Inclusion of a new subsection (5.7) on Solution Sets. • Addition of IRP Solution Sets Annex (C). • Inclusion of IRP Solution Sets in the Compliance conditions section (5.11) • Corrections to compliance conditions to align with 32.102 • Requirement 16 added to 4.1.1 stating that there shall be one name convention for 3GPP. • Removal of Editors Note from section 5.10 (Physical Level). • Addition of Section 8.6 Security Management and removal of Editors Note. • Correction of Figure Numbers throughout.
2.0.0	December 1999	Presentation to TSG-SA #6 (15 - 17 December, 1999) for approval