Technical Specification Group Services and System Aspects
Meeting #22, Maui, USA, 15-18 December 2003

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Source: SA5 (Telecom Management)

Title: 2 Rel-5/6 CR 32.102 (Telecommunication management; Architecture) : Replace the term UMTS in line with SA1/2 with 3G / 3GPP

Document for: Decision

Agenda Item: 7.5.3

Doc-1st-Level	Spec	CR	Rev	Ph	Subject	Cat	Ver-Cur	Doc-2nd-Level	WI
SP-030756	32.102	031	1	Rel-5	Replace the term UMTS in line with SA1/2 with 3G / 3GPP	F	5.4.0	-	OAM-AR
SP-030756	32.102	032	1	Rel-6	Replace the term UMTS in line with SA1/2 with 3G / 3GPP	A	6.0.0	-	OAM-AR

CR page 1

~~S5-032733~~

3GPP TSG-SA5 (Telecom Management)
Meeting #36, Shanghai, CHINA, 17 - 21 Nov 2003

CR-Form-v7

CHANGE REQUEST

⌘ **32.102 CR 031**	⌘ **rev** **-1** ⌘	Current version:	**5.4.0**	⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [X]

Title: ⌘	Replace the term UMTS in line with SA1/2 with 3G / 3GPP		
Source: ⌘	**SA5** /SA#22		
Work item code: ⌘	OAM-AR	***Date:*** ⌘	~~2~~15/12~~1~~/2003
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: ⌘	(1) To align with TS 32.101 and other specifications from e.g. SA1 & SA2 where 3G / 3GPP is often used now in place of UMTS (2) To show the applicability of TS 32.102 to all PLMNs (GSM, GPRS, 3GPP, 3GPP2 ……)
Summary of change: ⌘	Removal and Replacement of the term where deemed appropriate throughout 32.102 & other editorial corrections.
Consequences if not approved: ⌘	Mis-alignment with other specifications and failure to broaden applicability of 32.102

Clauses affected: ⌘	1, 3.1, 3.2, 4, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 5,6, 7.2, 7.3.1, 7.3.2, 7.3.3, 7.3.4,7.3.5,7.3.6, 7.4, 7.5, 8, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 9, 11, 12,13.4, Annex B				
	Y	**N**			
Other specs affected: ⌘	X	~~X~~	Other core specifications	⌘	Rel-6 32.102
		X	Test specifications		
		X	O&M Specifications		
Other comments: ⌘	Rel-6 Mirror CR attached. Revised (Reason: wrong history box i.e. Rel-6 i/o Rel-5)				

How to create CRs using this form:

KEEP the History box of the TS to be changed (see end of the present document)

Changes in Clause 1

1 Scope

The present document identifies and standardises the most important and strategic contexts in the physical architecture for the management of ~~UMTS~~PLMNs. It serves as a framework to help define a telecom management physical architecture for a planned ~~UMTS~~ PLMN and to adopt standards and provide products that are easy to integrate.

The requirements identified in the present document are applicable to all further development of ~~UMTS~~ 3GPP Telecom Management specifications as well as the development of ~~UMTS~~ PLMN Management products. The present document can be seen as guidance for the development of all other Technical Specification addressing the management of ~~UMTS~~PLMNs, except TS 32.101 [2].

End of Changes in Clause 1

Changes in Clause 3.1

management infrastructure: defined in TS 32.101 [2].~~collection of systems (computers and telecommunications) a UMTS PLMN Organisation has in order to manage UMTS~~~~its network.~~

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: 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 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: 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: 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.

PLMN Organisation: see 3GPP TS 32.101. ~~legal entity that is involved in the management of a telecommunications network providing mobile cellular services~~

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: 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: see IRP solution set.

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

standard: 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: 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 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): 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:** legal entity that is involved in the provisioning of UMTS~~

End of Changes in Clause 3.1

Changes in Clause 3.2

UML	Unified Modelling Language
~~UMTS~~	~~Universal Mobile Telecommunications System~~
USAT	USIM/SIM Application Toolkit

End of Changes in Clause 3.2

Changes in Clause 4 – 9 (and all sub clauses)

4 General

~~4.1 UMTS~~4.1 PLMN Telecom Management

4.1.1 ~~UMTS~~ 3GPP Reference Model

A ~~Universal Mobile Telecommunications~~3GPP System is made of the following components:

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

The ~~UMTS~~ 3GPP system components have signalling mechanisms among them (DSS1, INAP, MAP, SS7, RSVP etc.).

From the service perspective, the ~~UMTS~~ 3GPP system 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.

4.1.2 ~~UMTS~~ 3GPP Provisioning Entities

Two major entities, which cover the set of ~~UMTS~~ 3GPP functionalities involved in the provision of the ~~UMTS~~ 3GPP services to the user, are identified as follows:

- **Home Environment:** This entity holds the functionalities that enable a user to obtain ~~UMTS~~ 3GPP 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.

4.1.3 ~~UMTS~~ Management Infrastructure of the PLMN

Every ~~UMTS~~ PLMN Organisation has its 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~~ PLMN Organisation is very similar. Every ~~UMTS~~ PLMN Organisation:

- provides services to its 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~~ PLMN 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 TMN architecture).

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

4.2 TMN

TMN (Telecommunications Management Network), as defined in [1], provides:

- an architecture, made of OS (Operations Systems) and NEs (Network Elements), and the interfaces between them (Q, 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 TMN interfaces.

The PLMN~~3GPP~~~~UMTS~~ Management Architecture is largely based on TMN, and will reuse those functions, methods and interfaces already defined (or being defined) that are suitable for~~to~~ the management needs of a PLMN~~UMTS~~. However, ~~the UMTS~~ the new challenges of 3G Telecom ~~-~~Management may require the exploration~~needs to explore the~~ and incorporation of other concepts (other management paradigms widely accepted and deployed)~~ for the new challenges~~. ~~UMTS 3GPP PLMN faces~~.

5 General view of ~~UMTS~~ PLMN Management Physical architectures

Telecom Management Architectures can vary greatly in scope and detail. The architecture for a large service provider, with a lot of existing legacy systems and applications, upon which many services are based, will be of high complexity. In contrast, the architectural needs of a start-up mobile operator providing its services to a small group of value-added Service Providers will be much less and will probably focus on more short-term needs.

A mobile network operator has to manage many different types of networks as radio networks, exchanges, transmission networks, area networks, intelligent nodes and substantial amounts of computer hardware/software. This wide variety of network equipment will most probably be obtained from a variety of equipment vendors. The nature of a mobile radio network will be heterogeneous and will present a number of operational difficulties for the service provider on enabling effective and efficient network management.

The standardisation work for the management of ~~UMTS~~ a PLMN has adopted the top-down approach and will from business needs identify functional and informational architectures. The physical architecture will have to meet these requirements and as there are many ways to build a PLMN~~UMTS~~ it will vary greatly from one TMN solution to another. There will be many physical implementations, as different entities will take different roles in a PLMN~~UMTS~~.

It is obvious that it will not be meaningful or even possible to fully standardise a common Telecom Management physical architecture for PLMNs~~UMTS~~. The present document will identify and standardise the most important and strategic contexts and serve as a framework to help define a physical architecture for a planned PLMN~~UMTS~~.

6 Basic objectives for ~~a UMTS~~PLMN Management Physical Architecture

The management of a 3G~~PP~~ system~~UMTS~~ will put a lot of new requirements to the management systems compared to the second generation of Mobile telephony. Some of the challenging requirements affecting the physical architecture are:

- To be capable of managing equipment supplied by different vendors.
- To enable TM automation in a more cost efficient way - TM optimised for maximum efficiency and effectiveness.
- To provide PLMN~~UMTS~~ configuration capabilities that are flexible enough to allow rapid deployment of services.
- To report events and reactions in a common way in order to allow remote control.
- To allow interoperability between Network Operators/Service Providers for the exchange of management/charging information.

- To be scaleable and applicable to both larger and small deployments.
- Accessibility to information.
- To profit from advances and standards in IT and datacom industry.

The second generation of mobile networks can - from a management point of view - be characterised as the era of net-element vendor-dependent NE managers. The different OSs had very low interoperability with other systems and functional blocks could rarely be re-used. The Mobile Telecom Management Networks were far away from the TMN vision where one vendor's OS should be able to manage other vendor's' network elements.

For PLMN Organisations3GPP systemUMTS Management it is clearly stated the necessity of need cost-effective management solutions and better time to market focus. Interoperability, scalability and re-use are keywords for the new generation of management systems.

Many of the new requirements on the management of PLMNsUMTS can only be solved by defining and establish a suitable physical architecture. Thou it is not possible to standardise the one single UMTS TM physical architecture, it is evidently so that the success of a Telecom Management Network of a 3GPP systemUMTS PLMN Organisation will heavily depend on critical physical architectural issues. The present document will identify those architectural critical issues.

7 TM Architectural aspects

7.1 Architectural relationship

The basic aspects of a TM architecture, which can be, considered when planning and designing a TM network 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. Other constraints from realty will also have impact to the physical architecture as cost, performance, legacy systems and all preferences any operator will have on a big capital investment as a TM network.

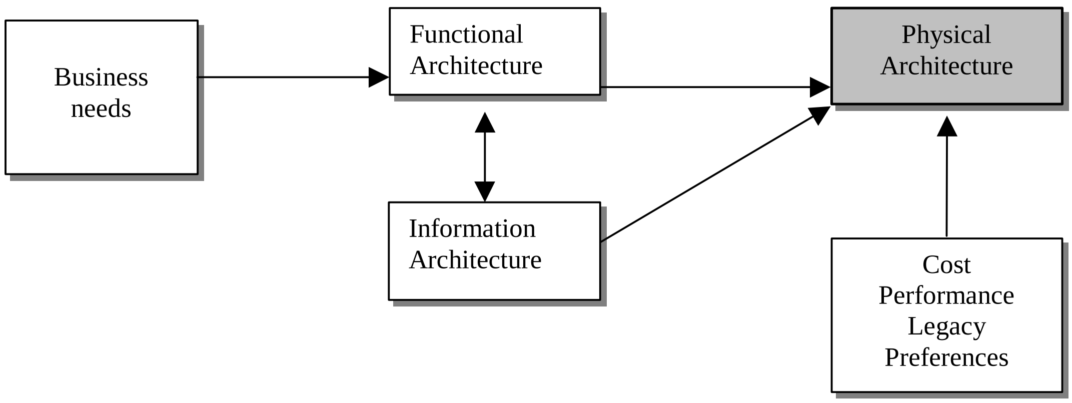

Figure 7.1: Architectural relationship

7.2 Architectural constraints

Large software systems, such as a network management system, are a capital investment that operators cannot afford to scrap every time its requirements change. Network operators are seeking cost-effective solutions to their short-term needs. All these reality-related issues are vital constraints that should be addressed in the definition of the architecture.

The standardisation of UMTS 3GPP systems will bring new and different services that will add new demands on network management. Every PLMNUMTS organisation will include different functionality depending on the role-played and the equipment used by that UMTS entity. Regulation may force some of the roles that shall be taken. The need to link systems across corporate boundaries will be a consequence of this.

The rapid evolution of new services and technologies will also put requirements on the PLMNUMTS physical management architecture to accommodate market and technology trends. To future-proof investments and continuously be able to take advantage of new technologies are important constraints to the physical architecture.

A PLMNUMTS TMN should also adopt an architecture that will achieve scalability and extensibility of systems and networks so the TMN can grow as the services expand over time. To start with a small TMN and easily be able to expand the TMN after new requirements will be important issues for most UMTS PLMN operators.

The Telecom Management Network will be just one part of the overall business of a company. System management, general security issues and development strategies can be the target for company policies. System architectures and technology choices, as well as the availability of off-the-shelf commercial systems and software components that fulfil the requirements established in the present document, may be critical to an operator's implementation of the specified UMTS management architecture.

7.3 Interoperability

7.3.1 Introduction

The new requirement on a UMTS 3GPP system TMN will imply a focus change from network element management towards management of information "information management". Network providers make use of different information in several different ways which also may vary from network to network and from time to time. Basic information as alarms is of course essential information for localising faults but may also be the key information to be able to set up a service with a service level agreement.

Numerous of different interfaces can be identified in a UMTS PLMN network in the areas of network element management, network management and service management. The most important and complex of these interfaces will be standardised but many interfaces of less importance are unlikely to be fully standardised and will be up to the individual operator and vendor to develop. To adopt mainstream computing technologies, re-use widely used protocols, standards and an open system architecture will be essential to secure interworking between all physical entities in a PLMNUMTS3GPP system.

Low-cost and general access to management systems information will be needed. Obviously this is the critical issue and challenging task in the heterogeneous, distributed and complex network of a PLMNUMTS3GPP system.

7.3.2 Interfaces

A UMTS 3GPP system PLMN will consist of many different types of components based on different types of technologies. There will be access-, core-, transmission- and service node networks and many of the UMTS components have already been the targets for Telecom Management standardisation at different levels. Many of these standards will be reused and the management domain of a UMTSPLMN will thereby consist of many TMNs. The architecture of UMTS3GPPPLMN TMNs should support distributed TMNs and TMN-interworking on peer-to-peer basis.

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

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

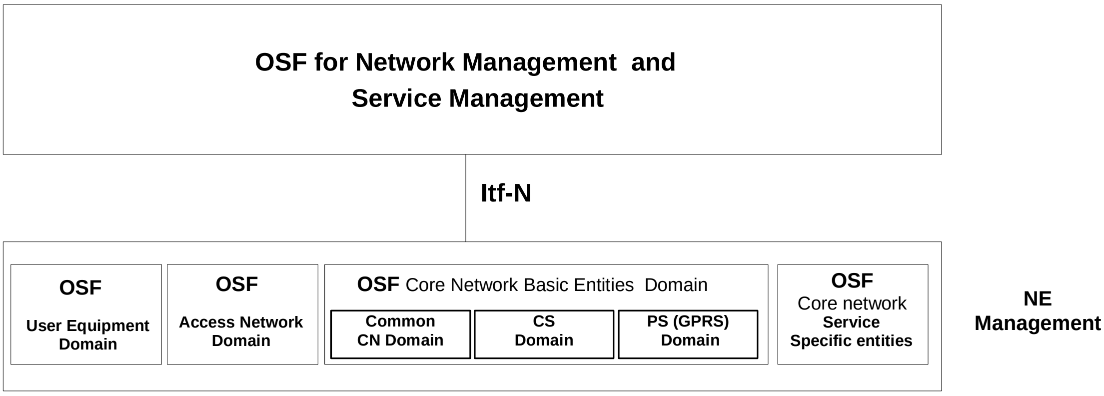

Figure 7.2: Overview of ~~UMTS~~ 3GPP Telecom Management Domains and Itf-N

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

This interface shall be open and the information models standardised.

Telecom management interfaces may be considered from two perspectives:

1) the management information model;

2) the management information exchange.

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

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

Application protocols can be categorised out of many capabilities as:

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

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

~~7.3.3 Entities of a UMTS~~7.3.3 Entities of a 3GPP system

To provide the mobile service as ~~it is~~ defined in a ~~UMTS~~3GPP system, some specific functions are introduced [12]. These functional entities can be implemented in different physical equipments or gathered. In any case, exchanges of data occur between these entities and from the Telecom Management perspective they can all normally be treated as network elements ~~of a UMTS~~. The basic telecom management functional areas such as fault management, configuration management, performance management and security management are all applicable to these ~~UMTS~~ entities. As such they are all the targets for ~~UMTS~~ 3GPP Telecom Management technical standards.

As discussed in clause 5, there will be many possible ways to build a ~~UMTS~~ 3GPP system and thereby many possible architectures of a mobile system. The entities presented in figure 7.3 should be treated as the fundamental building blocks of any possible implementation of a ~~UMTS~~3GPP system.

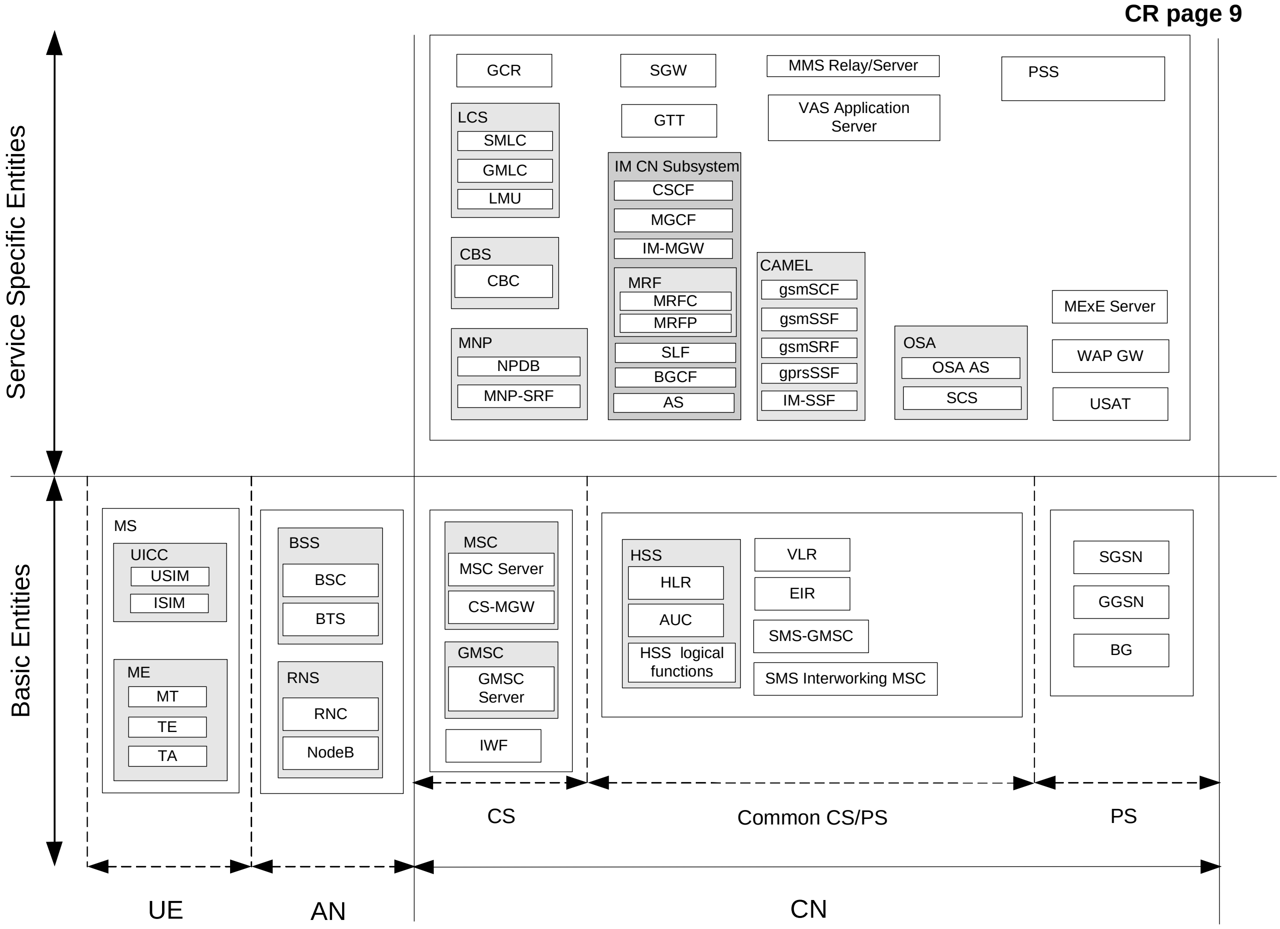

Figure 7.3 Examples of entities of the mobile system to be managed

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

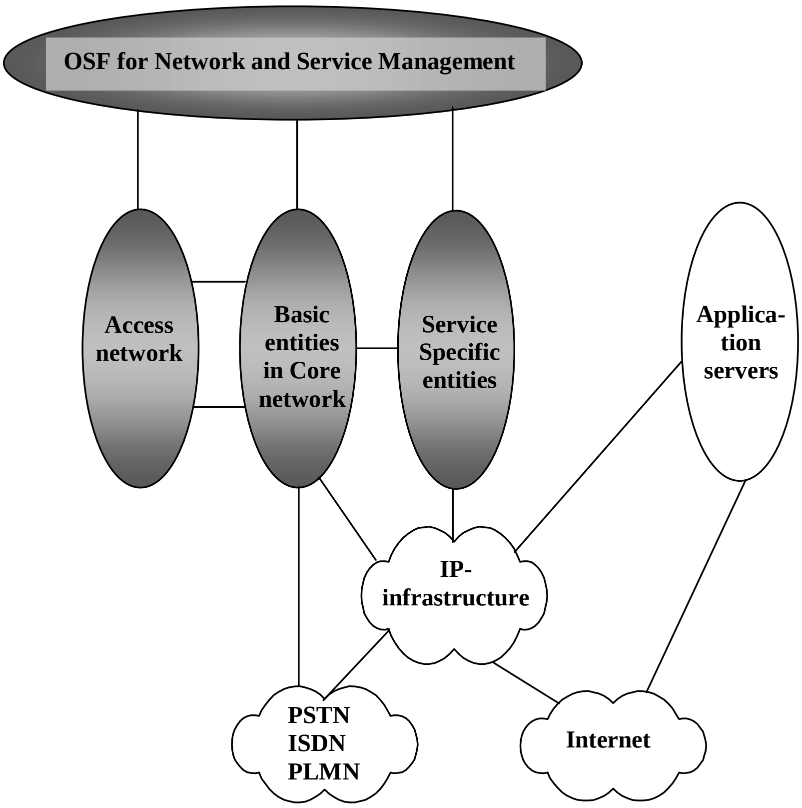

Figure 7.4 : High level 3GPP systemUMTS Network architecture

7.3.4 Open systems approach

Even in the second generation of mobile radio networks the operators has to cope with heterogeneous environments in many different ways. No single vendor is likely to deliver all the management systems needed for a mobile operator.

The many different types of network elements, some with very high management complexity as an exchange and some less complex as a repeater system, are generally supported with unique vendor specific management systems with very low interoperability. Duplicated TMN applications is another obvious reality of this generation of management systems. This will be further discussed under clause 9 (TMN Applications).

The new 3GPPUMTS requirements call for open systems that can be supported by the marketplace, rather than being supported by a single (or limited) set of suppliers, due to the unique aspects of the design chosen. Open systems architectures are achieved by having the design focus on commonly used and widely supported interface standards. This should ensure costs and quality that are controlled by the forces of competition in the marketplace.

The open systems approach is a technical and business strategy to:

- Choose commercially supported specifications and standards for selected system interfaces.
- Build systems based on modular hardware and software design.

Selection of commercial specifications and standards in the Open systems approach should be based on:

- Those adopted by industry consensus based standards bodies or de facto standards (those successful in the market place).
- Market research that evaluates the short and long term availability of products.
- Trade-offs of performance.
- Supportability and upgrade potential within defined cost constraint.

- Allowance for continued access to technological innovation supported by many customers and a broad industrial base.

7.3.5 Level of openness

The level the interfaces conform to open standards is critical for the overall behaviour. A low level of openness will severely impact on long-term supportability, interoperability, development lead-time, and lifecycle cost and overall performance.

Interfaces are expensive parts in a TMN and interfaces with low level of openness severely impact on development lead-time for the introduction of any system, application component or service. Easy implementation (plug & play) is a requirement for UMTS 3GPP TMN physical entities and requires a high the level of openness.

7.3.6 Closed interfaces

Many second-generation mobile network physical management entities have vendor controlled system/subsystem boundary descriptions that are not disclosed to the public or are unique to this single supplier - closed interfaces.

In a 3GPPUMTS network, Ssuch interfaces will not fulfil the basic requirements of a 3G TMN. and cannot be a part of a UMTS 3GPP TMN.

Closed interfaces can only be used as internal interfaces where no information what so ever has to be shared to other physical management entities.

7.4 Data communication networks

Within a TMN, the necessary physical connection (e.g. circuit-switched or packet-switched) may be offered by communication paths constructed with all kinds of network components, e.g. dedicated lines, packet-switched data network, ISDN, common channel signalling network, public-switched telephone network, local area networks, terminal controllers, etc. In the extreme case the communication path provides for full connectivity, i.e. each attached system can be physically connected to all others.

The TMN should be designed such that it has the capability to interface with several types of communications paths, to ensure that a framework is provided which is flexible enough to allow the most efficient communications:

- between NE and other elements within the TMN;
- between WS and other elements within the TMN;
- between elements within the TMN;
- between TMNs;
- between TMNs and enterprise.

In this case the term efficiency relates to the cost, reliability and maintainability of the data transported.

Two aspects impact costs. The first is the actual cost to transport data across the network between the TMN and the NE. The second aspect is the design of the interface including the selection of the appropriate communications protocol.

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 3GPP management interface, is a valid Networking Protocol for that interface.

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

- Capability to run over all supported bearers (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.

7.5 New technologies

Meeting application requirements in the most affordable manner ~~is~~ together with development lead-time are important issues identified in early ~~UMTS~~ 3GPP management standardisation work. But the TMN functional, information and physical architectures should also keep pace with the introduction of new technologies, services and evolving network infrastructures. Technology is advancing so rapidly today that this should be a fundamental part of the physical architecture – to be able to easily adopt new important technologies.

A ~~UMTS~~ 3GPP system will need to incorporate new successful technologies from the IT-world. ~~to which TMN standardisation is not fully applicable.~~ Today distributed computing implementations have matured to a point where the goals of TMN can be realised using commonly available technologies for a reasonable cost.

Widely accepted open standards and new IT-technologies will be indispensable to fulfil the challenging managing requirements of ~~UMTS~~a 3GPP system.

New technologies in the IT business such as generic application components together with distributed processing technology are new important drivers upon application design of management systems. The possibility to purchase functional components from the open market are of great importance from many aspects such as cost-efficiency and time-to-market.

8 ~~UMTS~~ 3GPP Management Physical architectures

A ~~UMTS~~ 3GPP Telecom Management Network will consist of many different management layers and many different building blocks. The complexity will vary greatly in detail because every organisation has different needs. The following clause will identify the most critical architectural issues and compliance conditions for a given ~~UMTS~~ 3GPP Management Interface. It should serve as fundamental requirements for any ~~UMTS~~ ~~PLMN~~ 3GPP entity (network element or management system) being a part of a ~~UMTS~~ 3GPP TMN.

8.1 Compliance Conditions

For a 3GPP~~UMTS~~ entity (Management System or NE) to be compliant to a given ~~UMTS~~ Management Interface, all the following conditions shall be satisfied:

1) It implements the management functionality following the Information Model and flows specified by the relevant 3GPP ~~UMTS~~ Management Interface Specifications applicable to that interface.

2) It provides at least one of the IRP Solution Sets (were available) related to the valid Application Protocols specified by 3GPP ~~UMTS~~ Application Protocols for that interface, [2] annex C.

3) It provides at least one standard networking protocol.

4) In case the entity does not offer the management interface on its own, a Q-Adapter shall be provided. This Q-Adapter shall be provided independently of any other ~~UMTS~~ NE and/or ~~UMTS~~ Management System.

5) Support for Bulk Transfer Application Protocols specified by the relevant 3GPP ~~UMTS~~ Management Interface Specifications applicable to that interface.

8.2 Network Element (NE) management architecture

Figure 8.1 shows two possible options for management interface from the OS upper layers to NE. Option 1, provides access to the NE via element manager, and Option 2, provides a direct access. It is sufficient to provide one or the other.

Figure 8.1 does not imply and limit the realisation of any OS physical block (e.g. E-OS, N-OS) to just one logical layer. OS physical blocks may span more than one logical layer (ITU-T Recommendation M.3010 (2000) [1]). Different types of network elements, different functional areas, operator and vendor preferences etc will put different constraints on the physical realisation of the OSFs. See further clause 9.

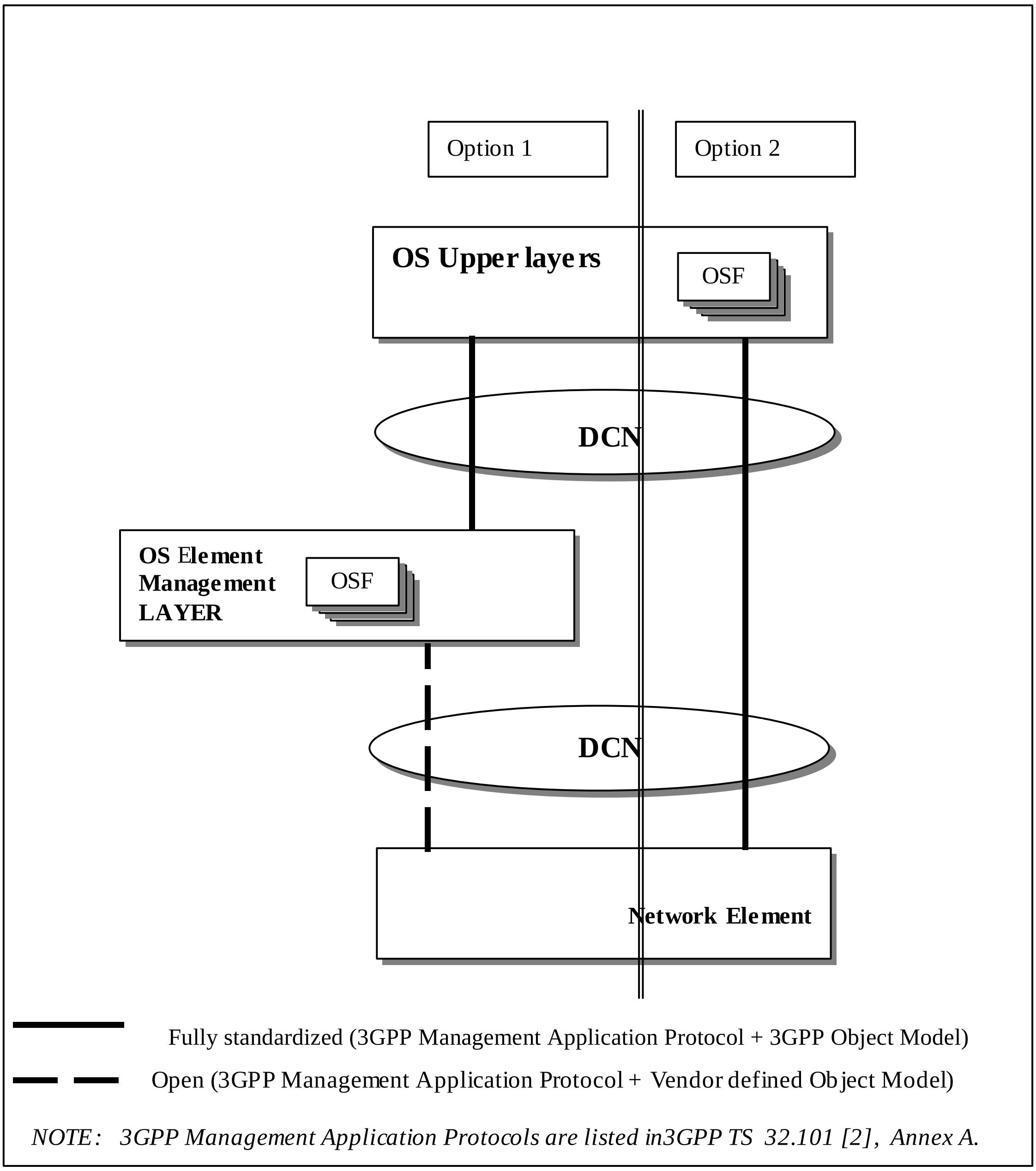

Figure 8.1: Network Element Management Architecture

For a ~~UMTS~~ 3GPP entity (Network Element or management system) to be compliant to a given ~~UMTS~~ Management Interface the following conditions shall all be satisfied:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models For an interface illustrated by the dashed line in figure 4 the object model is not standardised but it shall be open
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.3 Subnetwork Management Architecture

(Example ~~UMTS~~ 3GPP RNC / NodeB)

An important special case of the network element management architecture is where one type of network element such as the RNC will need management information for co-ordination of a subnetwork of other types of network elements such as NodeB.

This management information shared between the RNC and NodeB will not reach the operators and is not considered to be a part of the ~~UMTS~~ 3GPP TMN. All other management information related to NodeB will transparently be transferred by the RNC towards the ~~UMTS~~ 3GPP TMN.

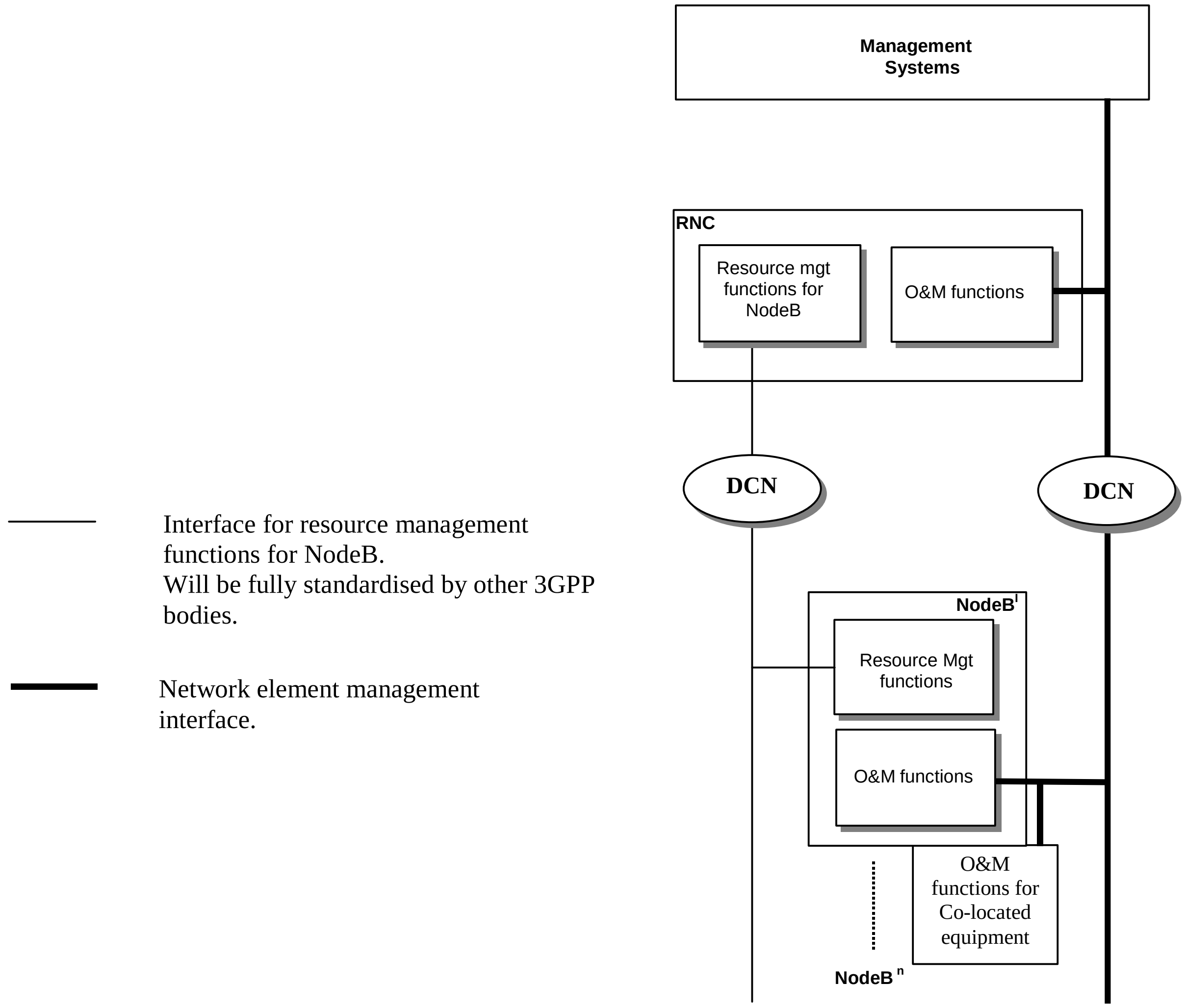

Figure 8.2: Subnetwork Management Architecture

The same compliance conditions apply for the subnetwork management architecture as for the network element management architecture (see clause 8.2).

8.4 Operations Systems interoperability architecture

Interoperability between operations systems is an important issue in a ~~UMTS~~3GPP system. Different organisations may take different roles in a ~~UMTS~~3GPP system. The need to share information across corporate boundaries will be a consequence of this.

The heterogeneous, distributed and complex network of a ~~UMTS~~ 3GPP system will be a market for many different vendors. All operations systems have to interoperate and shall be able to share information. This is a critical issue in the management of third generation systems.

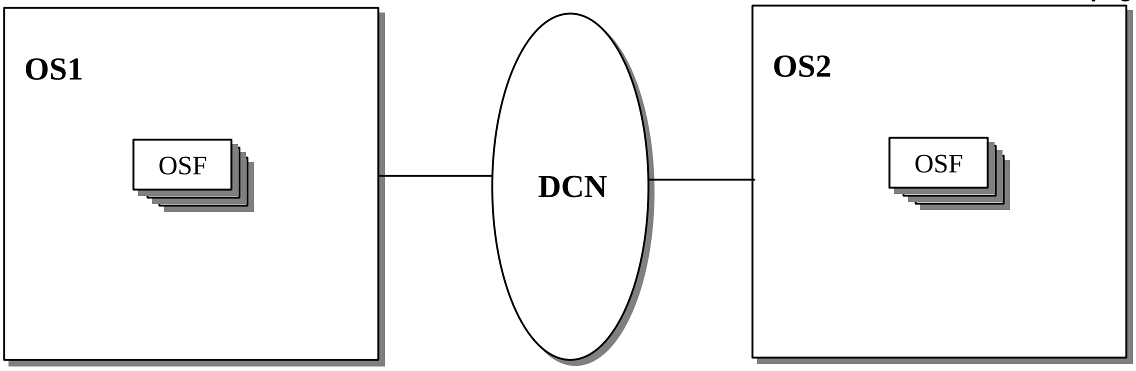

Figure 8.3: Operations Systems interoperability Architecture

For a Operations System to be ~~UMTS~~ 3GPP TMN compliant the following conditions shall all be satisfied:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.5 Operations Systems intra-operability architecture

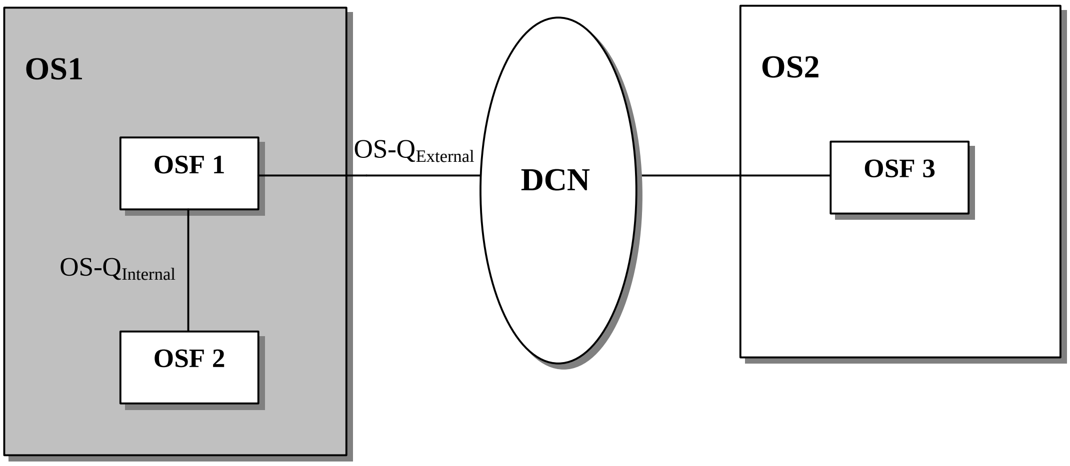

Figure 8.4: Operations Systems intra-operability Architecture

OS-$Q_{Internal}$ indicates an internal flow and is not standardised.

OS-$Q_{External}$ indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following conditions:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.6 Business System interconnection architecture

The business management layer has in the second-generation systems a very low degree of standardisation. Operators have legacy systems or more IT influenced systems often adopted to every organisations different needs. Business systems are not a part of a ~~UMTS~~ 3GPP TMN.

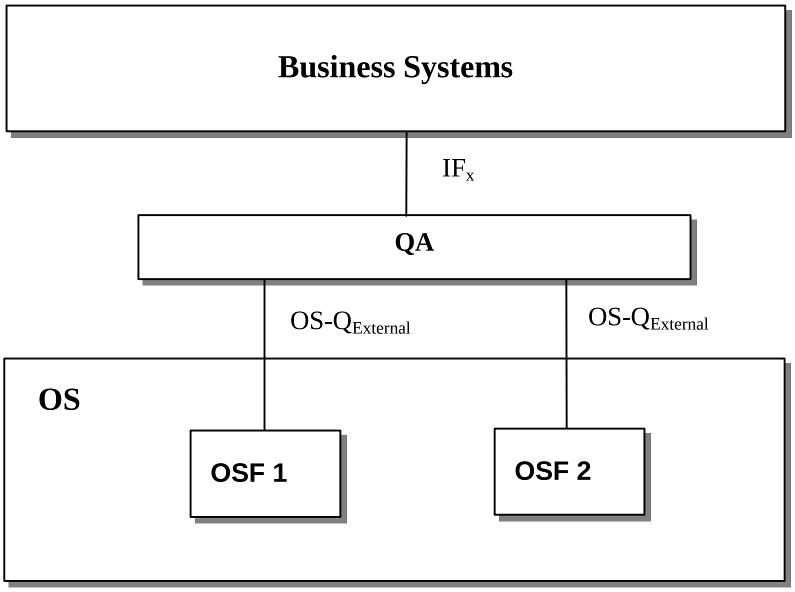

Figure 8.5: Business Systems interconnection architecture

$OS\text{-}Q_{Exteral}$ indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following conditions:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101[2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

IF_X indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following condition:

Item	Compliance conditions
1	Not standardised but open

9 TMN applications

Telecom management applications can be implemented in many different ways depending on constraints presented in previous clauses of the present document. Consistent operational processes are required for the management of the network irrespective of vendor equipment. A mobile operator can because of the very heterogeneous nature of their networks easily end of with dozens of duplicated applications for e g alarm surveillance. Most vendors of network equipment offers dedicated net-element managers and the ones not built with an open system approach will severely limit the possibility to report and manage the network in a consistent way.

Network element vendors with closed and unique network -element managers or operations systems with closed interfaces or interfaces with low level off openness will not fulfil the basic requirements as a part of a UMTS3GPP system. It will not be possible to design and build the Telecom Management Network to support the operational processes as required. Such physical entities are not under consideration in the present document.

Many TM application functions can be identified as generic functions used by all major types of telecom equipment. Alarm surveillance applications and performance analysing applications are generic necessities to manage most network elements. Security and system management applications are also common to many TM components and may be the scope for overall business policies.

To identify and specify the design criteria that will allow re-usable application components to be developed across multiple telecom business scenarios are important issues to fulfil the basic UMTS 3GPP Management requirement. "To minimise the costs of managing a UMTS PLMN network such that it is a small component of the overall operating cost".

The implication of the top down approach in the standardising work of UMTS 3GPP is that consistent operational management processes are required irrespective of vendor equipment.

Generic management applications is required to facilitate:

- Reduced management application development costs.
- Simplification of operational processes and associated reduction in costs.
- Reduced time to deploy new services as management systems already exist.
- Consistent representation of basic information.

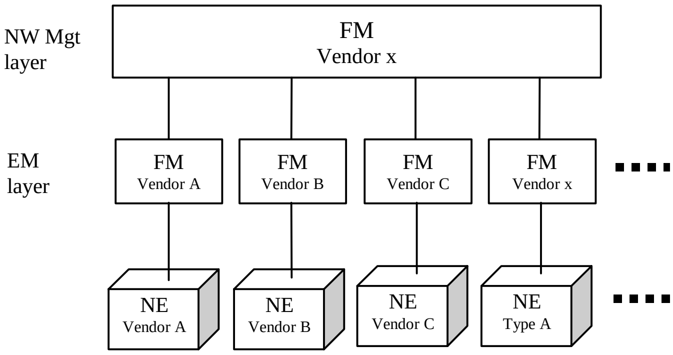

Figure 9.1: Unique NE Fault Management

Figure 9.1 represents a very common situation in the management of second generation of mobile networks. Different vendors supplied their network elements with unique net-element managers. The interfaces were mostly proprietary or unique. The information models for generic information such as alarms were rarely standardised. All together the consequence for the operators became very complex. Similar information at many levels, repeated acknowledge of alarms, inconsistent representation of similar information are a few of all the difficulties the operators had to cope with.

Some of the more severe implication of this situation is the difficulty to add more intelligence into the applications to better support the processes of the network providers. The operators who tried to brake up this situation had to put in a lot of effort into software development and proprietary interfaces. The marketplace did not support the needs of the operators.

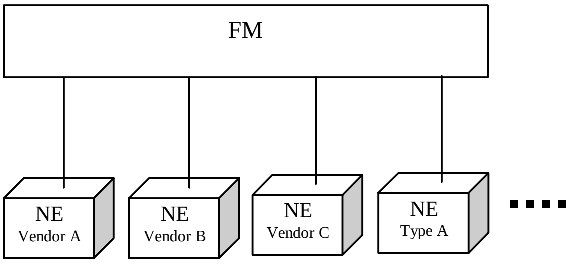

Figure 9.2: Generic Fault Management

Figure 9.2 indicates the situation were the Telecom Management process alarm surveillance is supported by a generic application for Fault Management. A common information model and accessibility to all related information will make it possible to add more intelligence to the management systems and to better support the management task.

TMN application functions such as billing information collection or configuration management of a specialised network element are examples of application that can be identified as unique applications. Even these applications will need to interoperate with other applications and will also need the open system approach to be a part of a ~~UMTS~~ 3G~~PP~~ TMN. With a network with many different types of network elements a common graphical user interface such as a web browser for configuration management applications could be an important issue to create consistent operational processes.

The complexity and heterogeneous nature of a ~~UMTS~~ 3G~~PP~~ system calls for easy integration (plug&play) of HW/SW.

End of Changes in Clause 4-9

Changes in Clause 11-13 (and all subclauses)

11 Implementation aspects

~~UMTS~~ PLMN operators might categories and organise its operation systems in many different ways as:

- A national fault and performance OS.
- A national charging, billing and accounting OS.
- Regional configuration OS.
- Regional fault, performance and configuration OS.
- etc.

This geographical dependent categorisation may change after time and the growth of the network. A physical architecture based on an open system design and re-usable application components would ease the work to adopt such structural changes. A management system build for a PLMN~~UMTS~~ ~~3GPP system~~ shall provide the possibility of layering the applications.

12 ~~UMTS~~ 3GPP TMN Conformance

The goal of TMN conformance (see M.3010 [1]) is to increase the probability that different implementations within a TMN will be able to interwork, that TMNs in different service/network provider's administrations and customer's system will be able to interwork as much as agreed on.

TMN conformance are testable conditions.

It is only the requirements on the external behaviour that have to be met by the conformance statements.

To finally guarantee interoperability the purchaser/user shall be able to test and verify that any two systems, claiming any type of TMN conformance, interoperate. Interoperability testing shall include:

- Testing of the interface protocols;
- The shared/exposed information over those interfaces;
- The interface functionality of the system.

A ~~UMTS~~ 3GPP TMN conformant entity shall support necessary information to support such interoperability testing namely:

- Statements made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities and options have been implemented.
- Detailed information to help determine which capabilities are testable and which are un-testable.
- Information needed in order to be able to run the appropriate test.
- The system interface documentation shall list the documents that define the specified ~~UMTS~~ information models with the inclusion of the version number and date.
- Necessary information about vendor supplied extensions of a standardised interface

The interface specification shall be documented, publicly available and licensable at reasonable price on a non-discriminatory basis.

Specific conformance guidelines shall be included in the different IRP solution sets. A ~~UMTS~~ 3GPP TMN conformant entity **must** support information stated in those conformance guidelines.

13 TMN planning and design considerations

A TMN should be designed such that it has the capability to interface with several types of communications paths to ensure that a framework is provided which is flexible enough to allow for the most efficient communications:

- Between one NE and other elements within the TMN;
- Between a WS and other elements within the TMN;
- Between elements within the TMN;
- Between TMNs.

The basis for choosing the appropriate interfaces, however, should be the functions performed by the elements between which appropriate communications are performed. The interface requirements are specified in terms of function attributes needed to provide the most efficient interface.

13.1 Function attributes

a) *Reliability* – The capability of the interface to ensure that data and control are transferred such that integrity and security are maintained.

b) *Frequency* – How often data is transferred across the interface boundary (Normal behaviour).

c) *Quantity* – The amount of data that is transferred across the interface during any transaction.

d) *Priority* – Indicates precedence to be given to data in case of competition for network resources with other functions.

e) *Availability* – Determines the use of redundancy in the design of the communications channels between interfacing elements.

f) *Delay* – Identifies the amount of buffering that may be tolerable between interfacing elements. This also impacts communications channel designs.

Table 3 suggests a possible ranges for these function attributes.

Table 3: Possible ranges for TMN function attributes [1]

Attributes		Requirements	Nature of attributes
Performance or grade of service (P)	Delay (speed)	Short Medium Long	Objective of design and control (acceptable/unacceptable but available/unavailable)
	Reliability (accuracy)	High Medium Low	
	Availability	High Medium Low	
Characteristics of TMN traffic (C)	Quantity	Large Medium Small	Condition or parameter of design
	Frequency	Often continuous Periodic Sparse	
	Priority	High Medium Low	

13.2 Functional characteristics

Each major type of telecommunications equipment has functional characteristic needs that can be used to describe the complexity of the interface.

There are, however, a basic group of TMN application functions that cross all major types of telecommunications equipment. There are also unique TMN application functions that are performed by specific categories of major telecommunications equipment. Alarm surveillance is an example of the former, whereas billing information collection is an example of the latter.

Functional characteristics of the elements within a TMN, e.g. OS, DCN and MD also describe the complexity of interfaces between these elements.

13.3 Critical attributes

Attribute values for a given function are generally consistent across the network elements.

When considering a single interface, it is important to identify the controlling attribute ranges for the design of the interface.

If there are conflicting attribute values for different functions in a given network element, more than one instance of an interface may be needed.

Overall TMN attribute values for the interfacing of elements within the TMN depend on the type and number of functions performed within these elements. In this case the functions are not consistent across TMN elements, but are controlled by the individual TMN design of an Administration.

13.4 Protocol selection

In many cases, more than one protocol suite will meet the requirements for the network element or TMN element under consideration. It is the approach for the 3GPP Telecom management standardisation to concentrate on protocol independent information models, allowing the mapping to several protocol suites.

The rationale behind this is:

- The blurring of Information and Telecommunication technologies in ~~UMTS~~a 3G~~PP~~ system, it is required to work on a more open approach (acknowledging the market status and foreseen evolutions).
- The lifecycle of information flows is 10 to 20 years, while the protocols is 5 to 10 years.
- The developments on automatic conversion allows for a more pragmatic and open approach.

The choice of the individual protocol from the recommended family will be left open to the vendors and operators.

To provide the most efficient interface care should be taken to select the protocol suite that optimises the relationship between the total cost to implement that protocol suite, the functional attributes and the data communications channels that carry the information across the interface.

13.5 Communications considerations

DCN architectures should be planned and designed to ensure that their implementation provides appropriate degrees of availability and network delay while minimising cost.

One should consider the selection of communications architectures, e.g. star, multipoint, loop, tree, etc.

The communications channels, e.g. dedicated lines, circuit-switched networks and packet networks used in providing the communications paths, also play an important role.

End of Changes in Clause 11-13

Changes in Annex B

Annex B (informative): Overview of a ~~UMTS Network~~~~PLMN~~ 3GPP System

Figure B.1 presents an example of a ~~UMTS network~~3GPP System~~PLMN~~, related management areas and introduces some management interfaces. ~~UMTS~~ 3GPP Service specific entities are not shown.

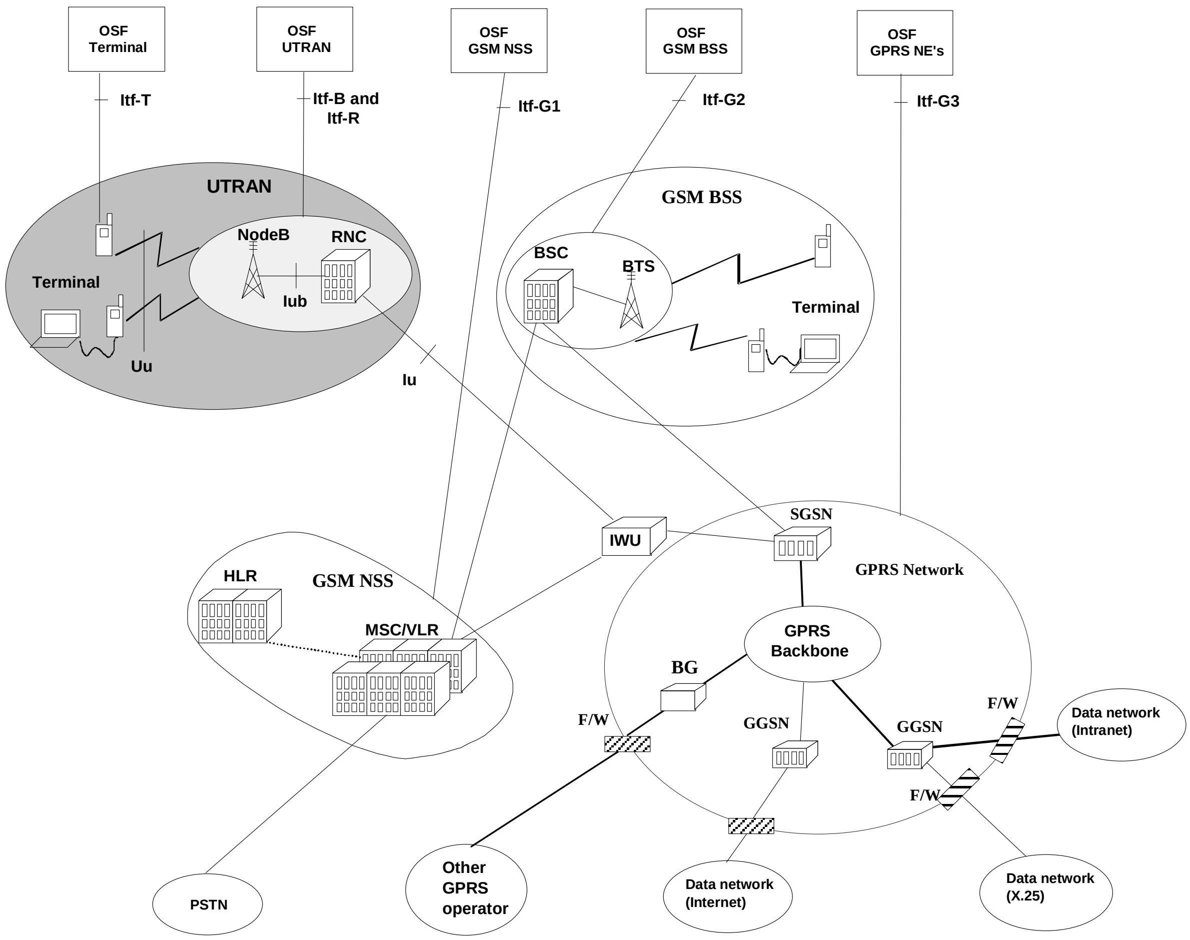

Figure B.1: Overview of a ~~UMTS Network~~3GPP System~~PLMN~~, showing management interfaces and management areas

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

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

End of Changes in Annex B

Annex H (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 1999	S_06	SP-99578	--	--	Approved at TSG SA #6 and placed under Change Control	-	3.0.0
Mar 2000	S_07	SP-000015	001	--	resolving remaining R99 inconsistency between 32.101 & 32.102	3.0.0	3.1.0
Mar 2000	S_07	SP-000015	002	--	Correction of IRP-related terminology	3.0.0	3.1.0
Mar 2000	--	--	--	--	Cosmetic	3.1.0	3.1.1
Jun 2000	S_08	SP-000227	003	--	Clarification of compliance conditions	3.1.1	3.2.0
Jun 2000	S_08	SP-000228	004	--	Update ITU-T TMN related reference material	3.1.1	3.2.0
Jun 2000	S_08	SP-000229	005	--	Definition of the Mandatory/Optional/Conditional qualifiers used in the IRPs	3.1.1	3.2.0
Jun 2000	S_08	SP-000230	006	--	Correction of erroneous editing and usage of undefined term	3.1.1	3.2.0
Mar 2001	S_11	SP-010026	007	--	Add UMTS TMN conformance	3.2.0	4.0.0
Jun 2001	S_12	SP-010232	008	--	Correction of ITU-T TMN concerns	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	009	--	Alignment with 3GPP drafting rules regarding headings	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	010	--	Update of TM architectural aspects	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	011	--	General clarifications and enhancements	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	012	--	Alignment with 3GPP drafting rules regarding verbal forms for the expression of provisions	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	013	--	Update and clarify compliance condition for a UMTS entity	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	014	--	Delete OSA definition	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	015	--	Enhancements of the IRP Concept	4.0.0	4.1.0
Sep 2001	S_13	SP-010466	016	--	Update and alignment of compliance conditions for UMTS Management Physical architectures	4.1.0	4.2.0
Sep 2001	S_13	SP-010522	017	--	Specify the Rule for IDL file names	4.1.0	4.2.0
Mar 2002	S_15	SP-020037	018	--	Add the rule on how all SA5 Solution Set specifications indicate a reference to a particular SA5 Information Service specification.	4.2.0	5.0.0
Mar 2002	S_15	SP-020037	019	--	Inclusion of the IMS in the 3G Telecom Management Architecture (32.102)	4.2.0	5.0.0
Sep 2002	S_17	SP-020450	020	--	Correction of diagrams describing entities of the mobile system to be managed	5.0.0	5.1.0
Sep 2002	S_17	SP-020450	021	--	IS Template Changes to support new UML Repertoire/Methodology	5.0.0	5.1.0
Sep 2002	S_17	SP-020450	022	--	Addition of 3GPP UML Repertoire for IRP: IS	5.0.0	5.1.0
Sep 2002	S_17	SP-020479	023	--	Add optional parameters in CORBA Solution Set IDLs	5.0.0	5.1.0
Dec 2002	S_18	SP-020726	024	--	Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)	5.1.0	5.2.0
Dec 2002	S_18	SP-020727	025	--	Updates and corrections to Integration Reference Points (IRPs) Introduction	5.1.0	5.2.0
Mar 2003	S_19	SP-030061	027	-	Add New Subclause to IS Template for Notification Related IOCs	5.2.0	5.3.0
Sep 2003	S_21	SP-030402	029	--	Correction of subclause X.2.1 in Annex C	5.3.0	5.4.0

3GPP TSG-SA5 (Telecom Management) ~~**S5-032734**~~
Meeting #36, Shanghai, CHINA, 17 - 21 Nov 2003

CR-Form-v7

CHANGE REQUEST

⌘ **32.102**	**CR** **032**	⌘ **rev** ~~**-**~~**1** ⌘	Current version:	**6.0.0** ⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [X]

Title: ⌘	Replace the term UMTS in line with SA1/2 with 3G / 3GPP		
Source: ⌘	**SA5** **/ SA#22**		
Work item code: ⌘	OAM-AR	***Date:*** ⌘	~~2~~15/1~~2~~1/2003
Category: ⌘	~~**F**~~ **A**	***Release:*** ⌘	Rel-6
	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: ⌘	(1) To align with TS32.101 and other specifications from e.g. SA1 & SA2 where 3G / 3GPP is often used now in place of UMTS (2) To show the applicability of TS 32.102 to all PLMNs (GSM, GPRS, 3GPP, 3GPP2 ……)
Summary of change: ⌘	Removal and Replacement of the term where deemed appropriate throughout 32.102 & other editorial corrections.
Consequences if not approved: ⌘	Mis-alignment with other specifications and failure to broaden applicability of 32.102

Clauses affected: ⌘	1, 3.1, 3.2, 4, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 5,6, 7.2, 7.3.1, 7.3.2, 7.3.3, 7.3.4,7.3.5,7.3.6, 7.4, 7.5, 8, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 9, 11, 12,13.4, Annex B			
	Y	**N**		
Other specs affected: ⌘		**X**	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	
Other comments: ⌘	Rel-6 Mirror CR of previous Rel-5 Cat F CR. Changes to this CR cover ONLY.			

How to create CRs using this form:

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

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

KEEP the History box of the TS to be changed (see end of the present document)

Changes in Clause 1

1 Scope

The present document identifies and standardises the most important and strategic contexts in the physical architecture for the management of UMTSPLMNs. It serves as a framework to help define a telecom management physical architecture for a planned UMTS PLMN and to adopt standards and provide products that are easy to integrate.

The requirements identified in the present document are applicable to all further development of UMTS 3GPP Telecom Management specifications as well as the development of UMTS PLMN Management products. The present document can be seen as guidance for the development of all other Technical Specification addressing the management of UMTSPLMNs, except TS 32.101 [2].

End of Changes in Clause 1

Changes in Clause 3.1

management infrastructure: defined in TS 32.101 [2]. collection of systems (computers and telecommunications) a UMTS Organisation has in order to manage UMTS

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: 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 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: 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: 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.

PLMN Organisation: see 3GPP TS 32.101.

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: 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: see IRP solution set.

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

standard: 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: 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 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): 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:** legal entity that is involved in the provisioning of UMTS~~

End of Changes in Clause 3.1

Changes in Clause 3.2

UML	Unified Modelling Language
~~UMTS~~	~~Universal Mobile Telecommunications System~~
USAT	USIM/SIM Application Toolkit

End of Changes in Clause 3.2

Changes in Clause 4 – 9 (and all sub clauses)

4 General

~~4.1 UMTS~~4.1 PLMN Telecom Management

4.1.1 ~~UMTS~~ 3GPP Reference Model

A ~~Universal Mobile Telecommunications~~3GPP System is made of the following components:

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

The ~~UMTS~~ 3GPP system components have signalling mechanisms among them (DSS1, INAP, MAP, SS7, RSVP etc.).

From the service perspective, the ~~UMTS~~ 3GPP system 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.

4.1.2 ~~UMTS~~ 3GPP Provisioning Entities

Two major entities, which cover the set of ~~UMTS~~ 3GPP functionalities involved in the provision of the ~~UMTS~~ 3GPP services to the user, are identified as follows:

- **Home Environment:** This entity holds the functionalities that enable a user to obtain ~~UMTS~~ 3GPP 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.

4.1.3 ~~UMTS~~ Management Infrastructure of the PLMN

Every ~~UMTS~~ PLMN Organisation has its 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~~ PLMN Organisation is very similar. Every ~~UMTS~~ PLMN Organisation:

- provides services to its 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~~ PLMN 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 TMN architecture).

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

4.2 TMN

TMN (Telecommunications Management Network), as defined in [1], provides:

- an architecture, made of OS (Operations Systems) and NEs (Network Elements), and the interfaces between them (Q, 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 TMN interfaces.

The PLMN~~UMTS~~ Management Architecture is largely based on TMN, and will reuse those functions, methods and interfaces already defined (or being defined) that are suitable ~~to~~ for the management needs of a PLMN~~UMTS~~. However, the new challenges of 3G ~~the UMTS~~Telecom Management ~~needs to~~ may require the exploratione and ~~the~~ incorporation of other concepts (other management paradigms widely accepted and deployed). ~~for the new challenges of 3G. UMTS faces.~~

5 General view of ~~UMTS~~ PLMN Management Physical architectures

Telecom Management Architectures can vary greatly in scope and detail. The architecture for a large service provider, with a lot of existing legacy systems and applications, upon which many services are based, will be of high complexity. In contrast, the architectural needs of a start-up mobile operator providing its services to a small group of value-added Service Providers will be much less and will probably focus on more short-term needs.

A mobile network operator has to manage many different types of networks as radio networks, exchanges, transmission networks, area networks, intelligent nodes and substantial amounts of computer hardware/software. This wide variety of network equipment will most probably be obtained from a variety of equipment vendors. The nature of a mobile radio network will be heterogeneous and will present a number of operational difficulties for the service provider on enabling effective and efficient network management.

The standardisation work for the management of ~~UMTS~~ a PLMN has adopted the top-down approach and will from business needs identify functional and informational architectures. The physical architecture will have to meet these requirements and as there are many ways to build a PLMN~~UMTS~~ it will vary greatly from one TMN solution to another. There will be many physical implementations, as different entities will take different roles in a PLMN~~UMTS~~.

It is obvious that it will not be meaningful or even possible to fully standardise a common Telecom Management physical architecture for PLMNs~~UMTS~~. The present document will identify and standardise the most important and strategic contexts and serve as a framework to help define a physical architecture for a planned PLMN~~UMTS~~.

6 Basic objectives for ~~a UMTS~~PLMN Management Physical Architecture

The management of a 3G system~~UMTS~~ will put a lot of new requirements to the management systems compared to the second generation of Mobile telephony. Some of the challenging requirements affecting the physical architecture are:

- To be capable of managing equipment supplied by different vendors.
- To enable TM automation in a more cost efficient way - TM optimised for maximum efficiency and effectiveness.
- To provide PLMN~~UMTS~~ configuration capabilities that are flexible enough to allow rapid deployment of services.
- To report events and reactions in a common way in order to allow remote control.
- To allow interoperability between Network Operators/Service Providers for the exchange of management/charging information.
- To be scaleable and applicable to both larger and small deployments.
- Accessibility to information.

- To profit from advances and standards in IT and datacom industry.

The second generation of mobile networks can - from a management point of view - be characterised as the era of ~~net-element~~ vendor-dependent NE managers. The different OSs had very low interoperability with other systems and functional blocks could rarely be re-used. The Mobile Telecom Management Networks were far away from the TMN vision where one vendor's OS should be able to manage other vendor~~'~~s’ network elements.

~~For~~ PLMN Organisations ~~UMTS Management it is clearly stated the necessity of~~ need cost-effective management solutions and better time to market focus. Interoperability, scalability and re-use are keywords for the new generation of management systems.

Many of the new requirements on the management of PLMNs~~UMTS~~ can only be solved by defining and establish a suitable physical architecture. Thou it is not possible to standardise the one single ~~UMTS~~ TM physical architecture, it is evidently so that the success of a Telecom Management Network of a ~~UMTS~~ PLMN Organisation will heavily depend on critical physical architectural issues. The present document will identify those architectural critical issues.

7 TM Architectural aspects

7.1 Architectural relationship

The basic aspects of a TM architecture, which can be, considered when planning and designing a TM network 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. Other constraints from realty will also have impact to the physical architecture as cost, performance, legacy systems and all preferences any operator will have on a big capital investment as a TM network.

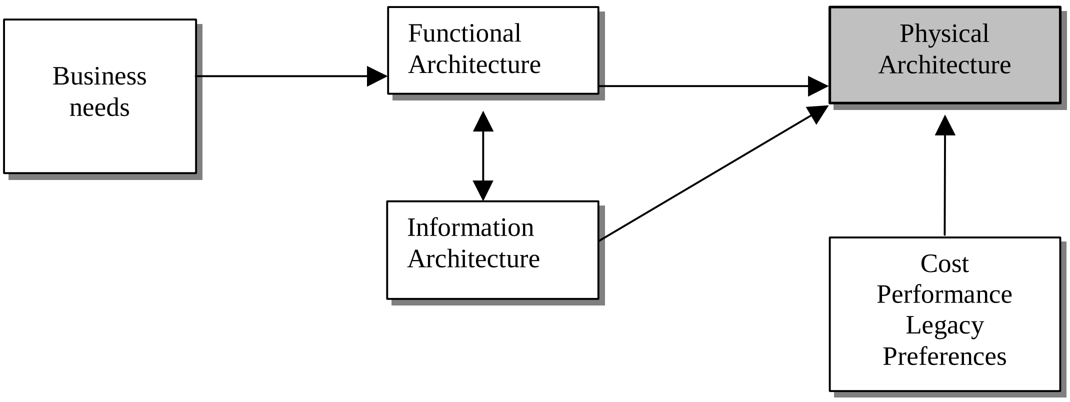

Figure 7.1: Architectural relationship

7.2 Architectural constraints

Large software systems, such as a network management system, are a capital investment that operators cannot afford to scrap every time its requirements change. Network operators are seeking cost-effective solutions to their short-term needs. All these reality-related issues are vital constraints that should be addressed in the definition of the architecture.

The standardisation of ~~UMTS~~ 3G systems will bring new and different services that will add new demands on network management. Every PLMN~~UMTS~~ organisation will include different functionality depending on the role-played and the equipment used by that ~~UMTS~~ entity. Regulation may force some of the roles that shall be taken. The need to link systems across corporate boundaries will be a consequence of this.

The rapid evolution of new services and technologies will also put requirements on the PLMN~~UMTS~~ physical management architecture to accommodate market and technology trends. To future-proof investments and continuously be able to take advantage of new technologies are important constraints to the physical architecture.

A PLMN~~UMTS~~ TMN should also adopt an architecture that will achieve scalability and extensibility of systems and networks so the TMN can grow as the services expand over time. To start with a small TMN and easily be able to expand the TMN after new requirements will be important issues for most ~~UMTS~~ PLMN operators.

The Telecom Management Network will be just one part of the overall business of a company. System management, general security issues and development strategies can be the target for company policies. System architectures and technology choices, as well as the availability of off-the-shelf commercial systems and software components that fulfil the requirements established in the present document, may be critical to an operator's implementation of the specified ~~UMTS~~ management architecture.

7.3 Interoperability

7.3.1 Introduction

The new requirement on a ~~UMTS~~ 3G system TMN will imply a focus change from network element management towards management of information "information management". Network providers make use of different information in several different ways which also may vary from network to network and from time to time. Basic information as alarms is of course essential information for localising faults but may also be the key information to be able to set up a service with a service level agreement.

Numerous of different interfaces can be identified in a ~~UMTS~~ PLMN network in the areas of network element management, network management and service management. The most important and complex of these interfaces will be standardised but many interfaces of less importance are unlikely to be fully standardised and will be up to the individual operator and vendor to develop. To adopt mainstream computing technologies, re-use widely used protocols, standards and an open system architecture will be essential to secure interworking between all physical entities in a PLMN~~UMTS~~.

Low-cost and general access to management systems information will be needed. Obviously this is the critical issue and challenging task in the heterogeneous, distributed and complex network of a PLMN~~UMTS~~.

7.3.2 Interfaces

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

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

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

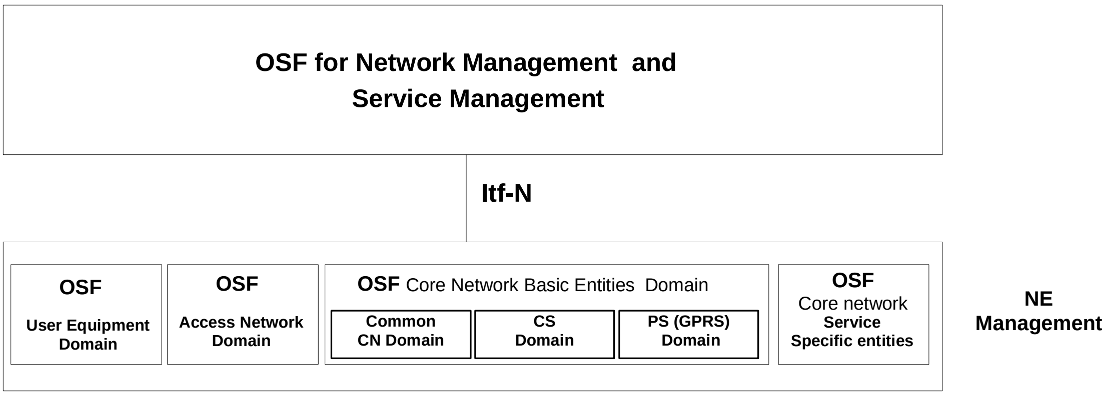

Figure 7.2: Overview of ~~UMTS~~ 3GPP Telecom Management Domains and Itf-N

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

This interface shall be open and the information models standardised.

Telecom management interfaces may be considered from two perspectives:

1) the management information model;

2) the management information exchange.

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

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

Application protocols can be categorised out of many capabilities as:

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

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

~~7.3.3 Entities of a UMTS~~7.3.3 Entities of a 3GPP system

To provide the mobile service as ~~it is~~ defined in a ~~UMTS~~3GPP system, some specific functions are introduced [12]. These functional entities can be implemented in different physical equipments or gathered. In any case, exchanges of data occur between these entities and from the Telecom Management perspective they can all normally be treated as network elements ~~of a UMTS~~. The basic telecom management functional areas such as fault management, configuration management, performance management and security management are all applicable to these ~~UMTS~~ entities. As such they are all the targets for ~~UMTS~~ 3GPP Telecom Management technical standards.

As discussed in clause 5, there will be many possible ways to build a ~~UMTS~~ 3GPP system and thereby many possible architectures of a mobile system. The entities presented in figure 7.3 should be treated as the fundamental building blocks of any possible implementation of a ~~UMTS~~3GPP system.

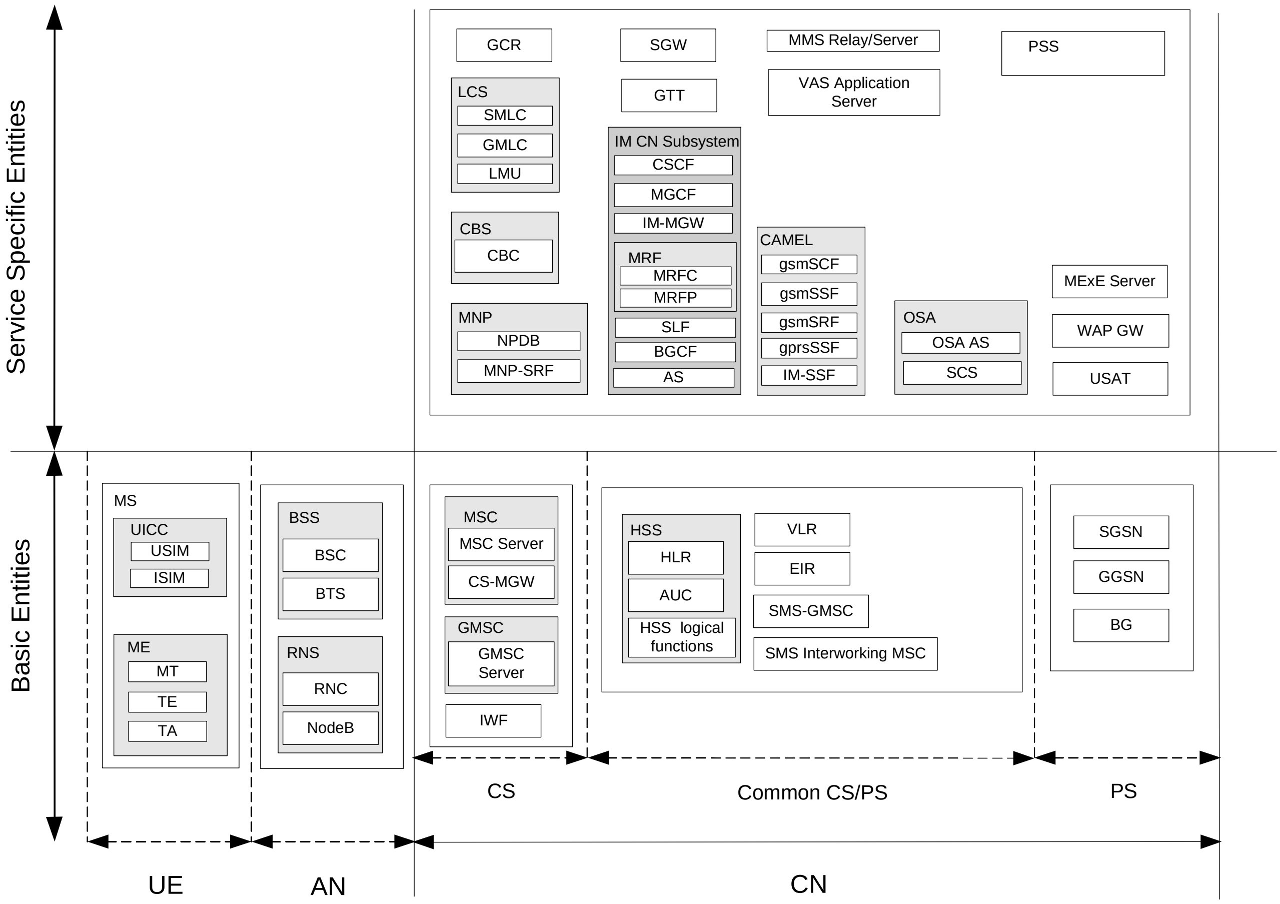

Figure 7.3 Examples of entities of the mobile system to be managed

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

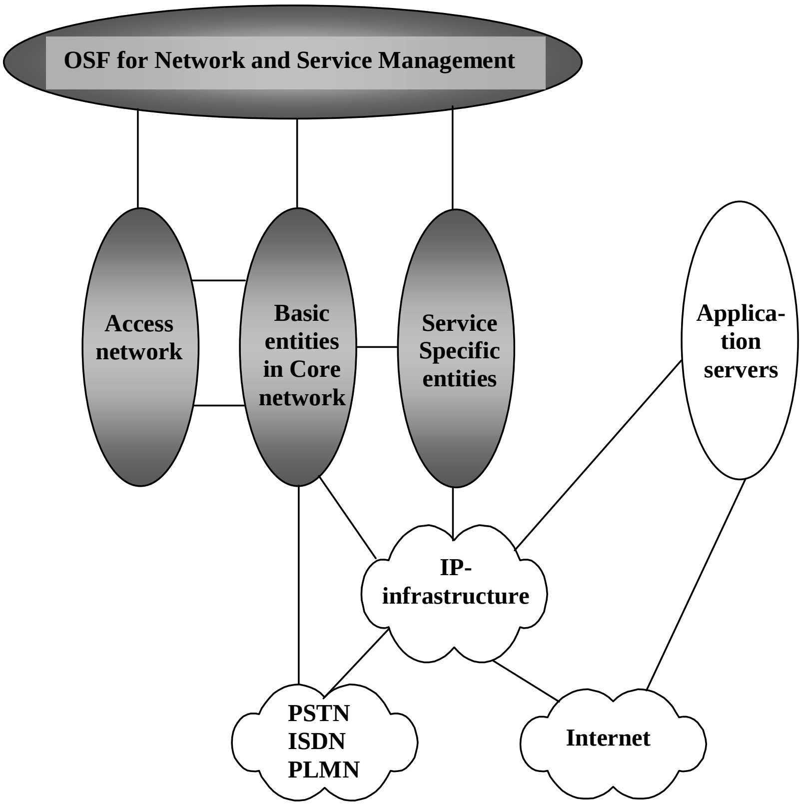

Figure 7.4 : High level 3GPP systemUMTS Network architecture

7.3.4 Open systems approach

Even in the second generation of mobile radio networks the operators has to cope with heterogeneous environments in many different ways. No single vendor is likely to deliver all the management systems needed for a mobile operator.

The many different types of network elements, some with very high management complexity as an exchange and some less complex as a repeater system, are generally supported with unique vendor specific management systems with very low interoperability. Duplicated TMN applications is another obvious reality of this generation of management systems. This will be further discussed under clause 9 (TMN Applications).

The new 3GUMTS requirements call for open systems that can be supported by the marketplace, rather than being supported by a single (or limited) set of suppliers, due to the unique aspects of the design chosen. Open systems architectures are achieved by having the design focus on commonly used and widely supported interface standards. This should ensure costs and quality that are controlled by the forces of competition in the marketplace.

The open systems approach is a technical and business strategy to:

- Choose commercially supported specifications and standards for selected system interfaces.
- Build systems based on modular hardware and software design.

Selection of commercial specifications and standards in the Open systems approach should be based on:

- Those adopted by industry consensus based standards bodies or de facto standards (those successful in the market place).
- Market research that evaluates the short and long term availability of products.
- Trade-offs of performance.
- Supportability and upgrade potential within defined cost constraint.

- Allowance for continued access to technological innovation supported by many customers and a broad industrial base.

7.3.5 Level of openness

The level the interfaces conform to open standards is critical for the overall behaviour. A low level of openness will severely impact on long-term supportability, interoperability, development lead-time, and lifecycle cost and overall performance.

Interfaces are expensive parts in a TMN and interfaces with low level of openness severely impact on development lead-time for the introduction of any system, application component or service. Easy implementation (plug & play) is a requirement for ~~UMTS~~ ~~3GPP~~ TMN physical entities and requires a high the level of openness.

7.3.6 Closed interfaces

Many second-generation mobile network physical management entities have vendor controlled system/subsystem boundary descriptions that are not disclosed to the public or are unique to this single supplier - closed interfaces.

~~In a UMTS network,~~ ~~S~~such interfaces will not fulfil the basic requirements of a 3G TMN. ~~and cannot be a part of a UMTS TMN.~~

Closed interfaces can only be used as internal interfaces where no information what so ever has to be shared to other physical management entities.

7.4 Data communication networks

Within a TMN, the necessary physical connection (e.g. circuit-switched or packet-switched) may be offered by communication paths constructed with all kinds of network components, e.g. dedicated lines, packet-switched data network, ISDN, common channel signalling network, public-switched telephone network, local area networks, terminal controllers, etc. In the extreme case the communication path provides for full connectivity, i.e. each attached system can be physically connected to all others.

The TMN should be designed such that it has the capability to interface with several types of communications paths, to ensure that a framework is provided which is flexible enough to allow the most efficient communications:

- between NE and other elements within the TMN;
- between WS and other elements within the TMN;
- between elements within the TMN;
- between TMNs;
- between TMNs and enterprise.

In this case the term efficiency relates to the cost, reliability and maintainability of the data transported.

Two aspects impact costs. The first is the actual cost to transport data across the network between the TMN and the NE. The second aspect is the design of the interface including the selection of the appropriate communications protocol.

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~~ 3GPP management interface, is a valid Networking Protocol for that interface.

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

- Capability to run over all supported bearers (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.

7.5 New technologies

Meeting application requirements in the most affordable manner ~~is~~ together with development lead-time are important issues identified in early ~~UMTS~~ 3GPP management standardisation work. But the TMN functional, information and physical architectures should also keep pace with the introduction of new technologies, services and evolving network infrastructures. Technology is advancing so rapidly today that this should be a fundamental part of the physical architecture – to be able to easily adopt new important technologies.

A ~~UMTS~~ 3GPP system will need to incorporate new successful technologies from the IT-world. ~~to which TMN standardisation is not fully applicable.~~ Today distributed computing implementations have matured to a point where the goals of TMN can be realised using commonly available technologies for a reasonable cost.

Widely accepted open standards and new IT-technologies will be indispensable to fulfil the challenging managing requirements of ~~UMTS~~a 3GPP system.

New technologies in the IT business such as generic application components together with distributed processing technology are new important drivers upon application design of management systems. The possibility to purchase functional components from the open market are of great importance from many aspects such as cost-efficiency and time-to-market.

8 ~~UMTS~~ 3GPP Management Physical architectures

A ~~UMTS~~ 3GPP Telecom Management Network will consist of many different management layers and many different building blocks. The complexity will vary greatly in detail because every organisation has different needs. The following clause will identify the most critical architectural issues and compliance conditions for a given ~~UMTS~~ 3GPP Management Interface. It should serve as fundamental requirements for any ~~UMTS~~ 3GPP entity (network element or management system) being a part of a ~~UMTS~~ 3GPP TMN.

8.1 Compliance Conditions

For a 3GPP~~UMTS~~ entity (Management System or NE) to be compliant to a given ~~UMTS~~ Management Interface, all the following conditions shall be satisfied:

1) It implements the management functionality following the Information Model and flows specified by the relevant 3GPP ~~UMTS~~ Management Interface Specifications applicable to that interface.

2) It provides at least one of the IRP Solution Sets (were available) related to the valid Application Protocols specified by 3GPP ~~UMTS~~ Application Protocols for that interface, [2] annex C.

3) It provides at least one standard networking protocol.

4) In case the entity does not offer the management interface on its own, a Q-Adapter shall be provided. This Q-Adapter shall be provided independently of any other ~~UMTS~~ NE and/or ~~UMTS~~ Management System.

5) Support for Bulk Transfer Application Protocols specified by the relevant 3GPP ~~UMTS~~ Management Interface Specifications applicable to that interface.

8.2 Network Element (NE) management architecture

Figure 8.1 shows two possible options for management interface from the OS upper layers to NE. Option 1, provides access to the NE via element manager, and Option 2, provides a direct access. It is sufficient to provide one or the other.

Figure 8.1 does not imply and limit the realisation of any OS physical block (e.g. E-OS, N-OS) to just one logical layer. OS physical blocks may span more than one logical layer (ITU-T Recommendation M.3010 (2000) [1]). Different types of network elements, different functional areas, operator and vendor preferences etc will put different constraints on the physical realisation of the OSFs. See further clause 9.

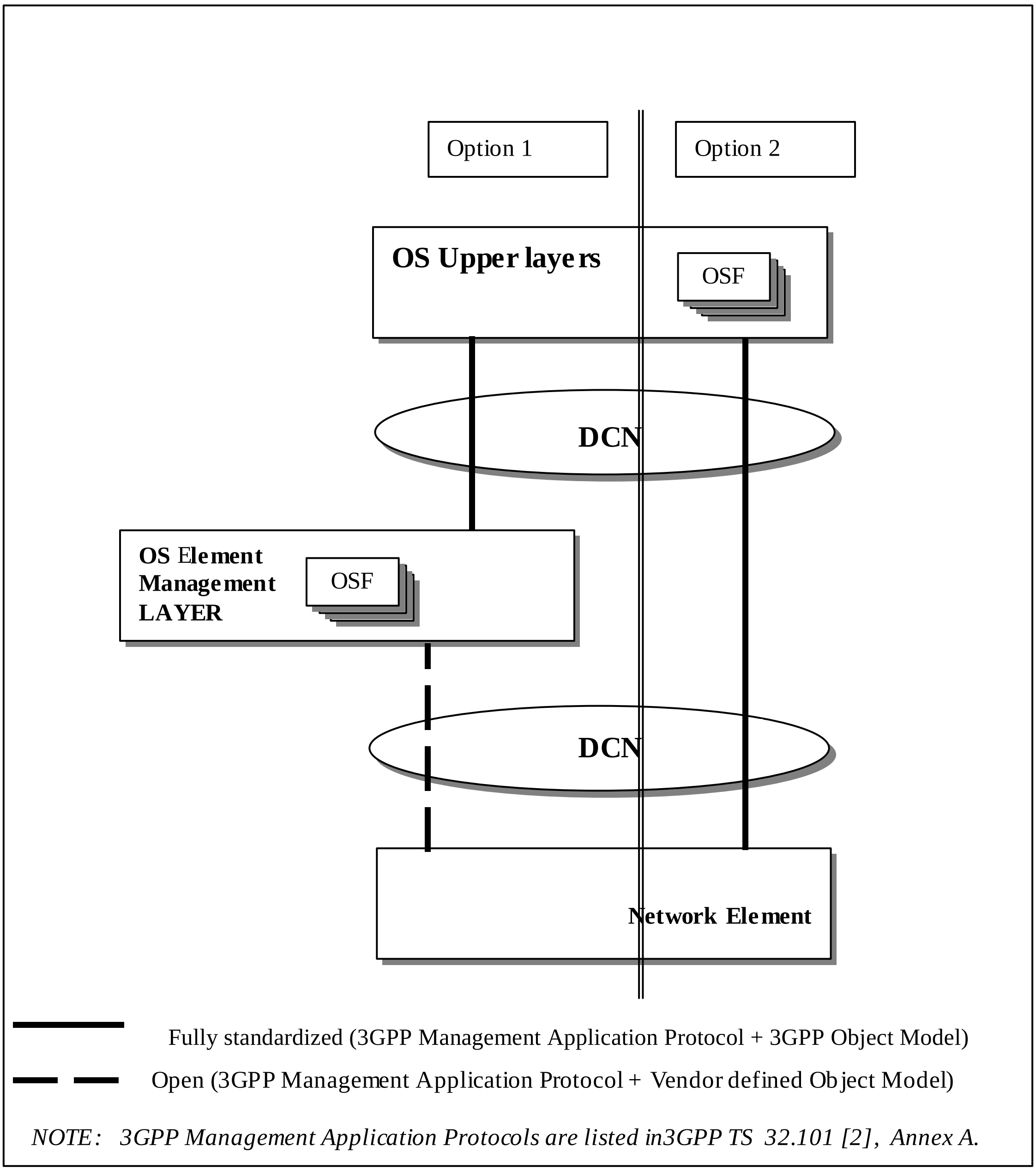

Figure 8.1: Network Element Management Architecture

For a ~~UMTS~~ 3GPP entity (Network Element or management system) to be compliant to a given ~~UMTS~~ Management Interface the following conditions shall all be satisfied:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models For an interface illustrated by the dashed line in figure 4 the object model is not standardised but it shall be open
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.3 Subnetwork Management Architecture

(Example ~~UMTS~~ 3GPP RNC / NodeB)

An important special case of the network element management architecture is where one type of network element such as the RNC will need management information for co-ordination of a subnetwork of other types of network elements such as NodeB.

This management information shared between the RNC and NodeB will not reach the operators and is not considered to be a part of the ~~UMTS~~ 3GPP TMN. All other management information related to NodeB will transparently be transferred by the RNC towards the ~~UMTS~~ 3GPP TMN.

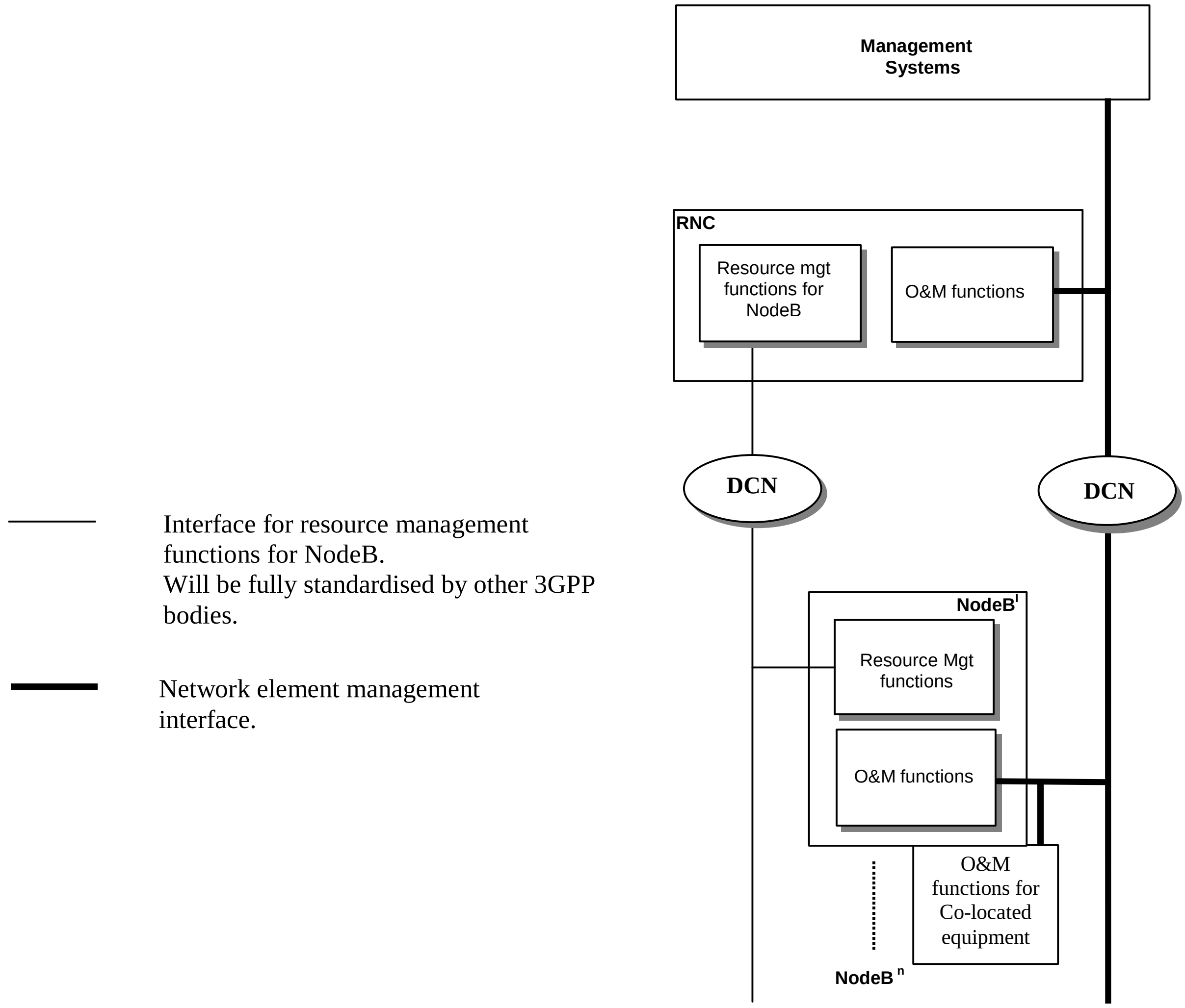

Figure 8.2: Subnetwork Management Architecture

The same compliance conditions apply for the subnetwork management architecture as for the network element management architecture (see clause 8.2).

8.4 Operations Systems interoperability architecture

Interoperability between operations systems is an important issue in a ~~UMTS~~3GPP system. Different organisations may take different roles in a ~~UMTS~~3GPP system. The need to share information across corporate boundaries will be a consequence of this.

The heterogeneous, distributed and complex network of a ~~UMTS~~ 3GPP system will be a market for many different vendors. All operations systems have to interoperate and shall be able to share information. This is a critical issue in the management of third generation systems.

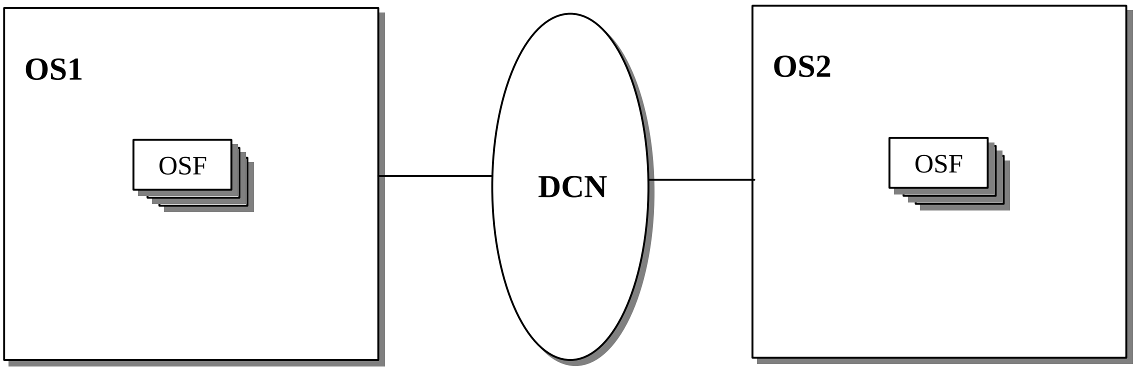

Figure 8.3: Operations Systems interoperability Architecture

For a Operations System to be ~~UMTS~~ 3GPP TMN compliant the following conditions shall all be satisfied:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.5 Operations Systems intra-operability architecture

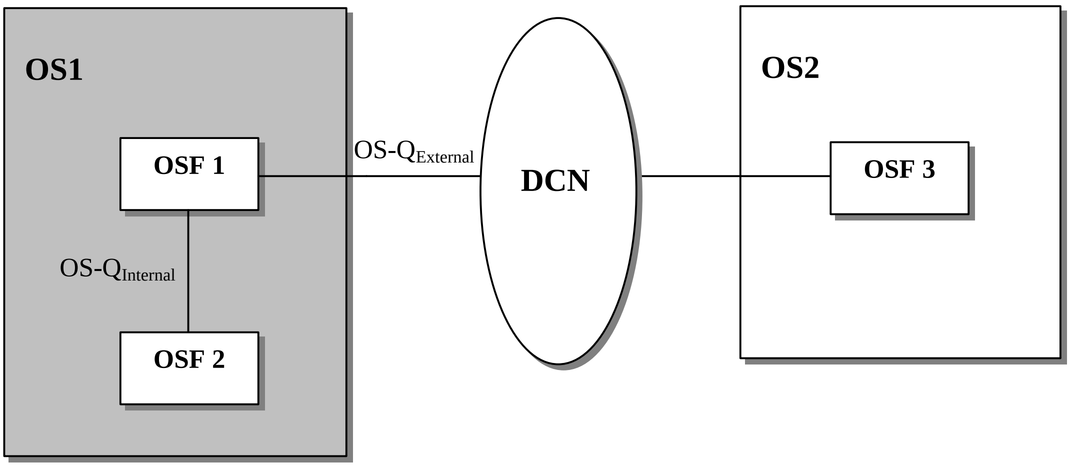

Figure 8.4: Operations Systems intra-operability Architecture

OS-$Q_{Internal}$ indicates an internal flow and is not standardised.

OS-$Q_{External}$ indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following conditions:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101 [2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

8.6 Business System interconnection architecture

The business management layer has in the second-generation systems a very low degree of standardisation. Operators have legacy systems or more IT influenced systems often adopted to every organisations different needs. Business systems are not a part of a ~~UMTS~~ 3GPP TMN.

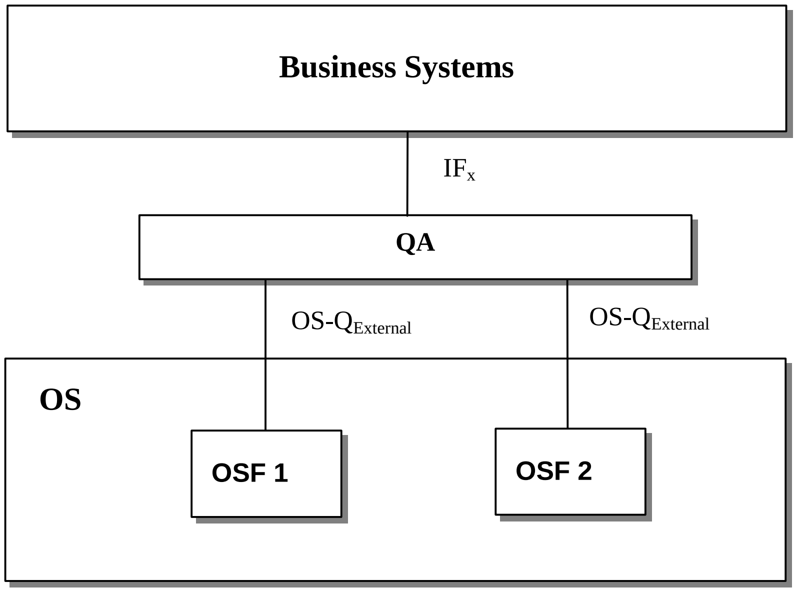

Figure 8.5: Business Systems interconnection architecture

OS-$Q_{Exteral}$ indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following conditions:

Item	Compliance conditions
1	Implements relevant 3GPP IRP Information Services and Network Resource Models
2	Application protocol (e.g. CMIP,SNMP,CORBA IIOP) (Defined in TS 32.101[2], annex A) If 3GPP has specified one or more IRP Solution Sets corresponding to the IRP Information Models in item 1 then at least one of those IRP Solution Sets shall be supported. (Defined in TS 32.101 [2], annex C)
3	Valid Network Layer Protocol (see annex B of TS 32.101 [2])
4	Lower protocol levels required by Item 1,2 and 3

IF$_X$ indicates an external flow and shall to be compliant to a given ~~UMTS~~ 3GPP Management Interface satisfy the following condition:

Item	Compliance conditions
1	Not standardised but open

9 TMN applications

Telecom management applications can be implemented in many different ways depending on constraints presented in previous clauses of the present document. Consistent operational processes are required for the management of the network irrespective of vendor equipment. A mobile operator can because of the very heterogeneous nature of their networks easily end of with dozens of duplicated applications for e g alarm surveillance. Most vendors of network equipment offers dedicated net-element managers and the ones not built with an open system approach will severely limit the possibility to report and manage the network in a consistent way.

Network element vendors with closed and unique network ~~-~~element managers or operations systems with closed interfaces or interfaces with low level off openness will not fulfil the basic requirements as a part of a ~~UMTS~~3G system. It will not be possible to design and build the Telecom Management Network to support the operational processes as required. Such physical entities are not under consideration in the present document.

Many TM application functions can be identified as generic functions used by all major types of telecom equipment. Alarm surveillance applications and performance analysing applications are generic necessities to manage most network elements. Security and system management applications are also common to many TM components and may be the scope for overall business policies.

To identify and specify the design criteria that will allow re-usable application components to be developed across multiple telecom business scenarios are important issues to fulfil the basic ~~UMTS~~ 3G Management requirement. "To minimise the costs of managing a ~~UMTS~~ PLMN ~~network~~ such that it is a small component of the overall operating cost".

The implication of the top down approach in the standardising work of ~~UMTS~~ 3G is that consistent operational management processes are required irrespective of vendor equipment.

Generic management applications is required to facilitate:

- Reduced management application development costs.
- Simplification of operational processes and associated reduction in costs.
- Reduced time to deploy new services as management systems already exist.
- Consistent representation of basic information.

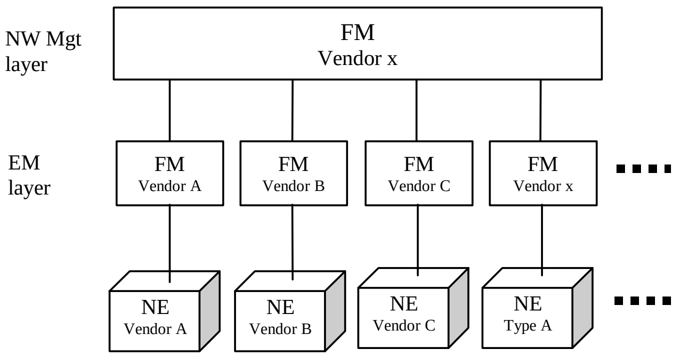

Figure 9.1: Unique NE Fault Management

Figure 9.1 represents a very common situation in the management of second generation of mobile networks. Different vendors supplied their network elements with unique net-element managers. The interfaces were mostly proprietary or unique. The information models for generic information such as alarms were rarely standardised. All together the consequence for the operators became very complex. Similar information at many levels, repeated acknowledge of alarms, inconsistent representation of similar information are a few of all the difficulties the operators had to cope with.

Some of the more severe implication of this situation is the difficulty to add more intelligence into the applications to better support the processes of the network providers. The operators who tried to brake up this situation had to put in a lot of effort into software development and proprietary interfaces. The marketplace did not support the needs of the operators.

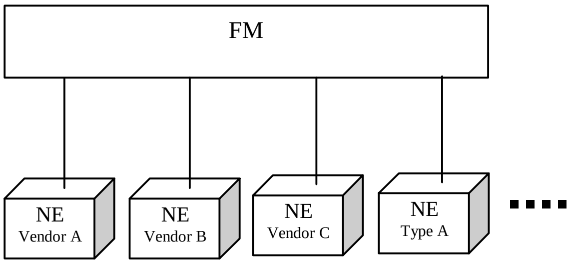

Figure 9.2: Generic Fault Management

Figure 9.2 indicates the situation were the Telecom Management process alarm surveillance is supported by a generic application for Fault Management. A common information model and accessibility to all related information will make it possible to add more intelligence to the management systems and to better support the management task.

TMN application functions such as billing information collection or configuration management of a specialised network element are examples of application that can be identified as unique applications. Even these applications will need to interoperate with other applications and will also need the open system approach to be a part of a ~~UMTS~~ 3G TMN. With a network with many different types of network elements a common graphical user interface such as a web browser for configuration management applications could be an important issue to create consistent operational processes.

The complexity and heterogeneous nature of a ~~UMTS~~ 3G system calls for easy integration (plug&play) of HW/SW.

End of Changes in Clause 4-9

Changes in Clause 11-13 (and all subclauses)

11 Implementation aspects

~~UMTS~~ PLMN operators might categories and organise its operation systems in many different ways as:

- A national fault and performance OS.
- A national charging, billing and accounting OS.
- Regional configuration OS.
- Regional fault, performance and configuration OS.
- etc.

This geographical dependent categorisation may change after time and the growth of the network. A physical architecture based on an open system design and re-usable application components would ease the work to adopt such structural changes. A management system build for a PLMN~~UMTS~~ shall provide the possibility of layering the applications.

12 ~~UMTS~~ 3GPP TMN Conformance

The goal of TMN conformance (see M.3010 [1]) is to increase the probability that different implementations within a TMN will be able to interwork, that TMNs in different service/network provider's administrations and customer's system will be able to interwork as much as agreed on.

TMN conformance are testable conditions.

It is only the requirements on the external behaviour that have to be met by the conformance statements.

To finally guarantee interoperability the purchaser/user shall be able to test and verify that any two systems, claiming any type of TMN conformance, interoperate. Interoperability testing shall include:

- Testing of the interface protocols;
- The shared/exposed information over those interfaces;
- The interface functionality of the system.

A ~~UMTS~~ 3GPP TMN conformant entity shall support necessary information to support such interoperability testing namely:

- Statements made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities and options have been implemented.
- Detailed information to help determine which capabilities are testable and which are un-testable.
- Information needed in order to be able to run the appropriate test.
- The system interface documentation shall list the documents that define the specified ~~UMTS~~ information models with the inclusion of the version number and date.
- Necessary information about vendor supplied extensions of a standardised interface

The interface specification shall be documented, publicly available and licensable at reasonable price on a non-discriminatory basis.

Specific conformance guidelines shall be included in the different IRP solution sets. A ~~UMTS~~ 3GPP TMN conformant entity **must** support information stated in those conformance guidelines.

13 TMN planning and design considerations

A TMN should be designed such that it has the capability to interface with several types of communications paths to ensure that a framework is provided which is flexible enough to allow for the most efficient communications:

- Between one NE and other elements within the TMN;
- Between a WS and other elements within the TMN;
- Between elements within the TMN;
- Between TMNs.

The basis for choosing the appropriate interfaces, however, should be the functions performed by the elements between which appropriate communications are performed. The interface requirements are specified in terms of function attributes needed to provide the most efficient interface.

13.1 Function attributes

a) *Reliability* – The capability of the interface to ensure that data and control are transferred such that integrity and security are maintained.

b) *Frequency* – How often data is transferred across the interface boundary (Normal behaviour).

c) *Quantity* – The amount of data that is transferred across the interface during any transaction.

d) *Priority* – Indicates precedence to be given to data in case of competition for network resources with other functions.

e) *Availability* – Determines the use of redundancy in the design of the communications channels between interfacing elements.

f) *Delay* – Identifies the amount of buffering that may be tolerable between interfacing elements. This also impacts communications channel designs.

Table 3 suggests a possible ranges for these function attributes.

Table 3: Possible ranges for TMN function attributes [1]

Attributes		Requirements	Nature of attributes
Performance or grade of service (P)	Delay (speed)	Short Medium Long	Objective of design and control (acceptable/unacceptable but available/unavailable)
	Reliability (accuracy)	High Medium Low	
	Availability	High Medium Low	
Characteristics of TMN traffic (C)	Quantity	Large Medium Small	Condition or parameter of design
	Frequency	Often continuous Periodic Sparse	
	Priority	High Medium Low	

13.2 Functional characteristics

Each major type of telecommunications equipment has functional characteristic needs that can be used to describe the complexity of the interface.

There are, however, a basic group of TMN application functions that cross all major types of telecommunications equipment. There are also unique TMN application functions that are performed by specific categories of major telecommunications equipment. Alarm surveillance is an example of the former, whereas billing information collection is an example of the latter.

Functional characteristics of the elements within a TMN, e.g. OS, DCN and MD also describe the complexity of interfaces between these elements.

13.3 Critical attributes

Attribute values for a given function are generally consistent across the network elements.

When considering a single interface, it is important to identify the controlling attribute ranges for the design of the interface.

If there are conflicting attribute values for different functions in a given network element, more than one instance of an interface may be needed.

Overall TMN attribute values for the interfacing of elements within the TMN depend on the type and number of functions performed within these elements. In this case the functions are not consistent across TMN elements, but are controlled by the individual TMN design of an Administration.

13.4 Protocol selection

In many cases, more than one protocol suite will meet the requirements for the network element or TMN element under consideration. It is the approach for the 3GPP Telecom management standardisation to concentrate on protocol independent information models, allowing the mapping to several protocol suites.

The rationale behind this is:

- The blurring of Information and Telecommunication technologies in ~~UMTS~~a 3G system, it is required to work on a more open approach (acknowledging the market status and foreseen evolutions).
- The lifecycle of information flows is 10 to 20 years, while the protocols is 5 to 10 years.
- The developments on automatic conversion allows for a more pragmatic and open approach.

The choice of the individual protocol from the recommended family will be left open to the vendors and operators.

To provide the most efficient interface care should be taken to select the protocol suite that optimises the relationship between the total cost to implement that protocol suite, the functional attributes and the data communications channels that carry the information across the interface.

13.5 Communications considerations

DCN architectures should be planned and designed to ensure that their implementation provides appropriate degrees of availability and network delay while minimising cost.

One should consider the selection of communications architectures, e.g. star, multipoint, loop, tree, etc.

The communications channels, e.g. dedicated lines, circuit-switched networks and packet networks used in providing the communications paths, also play an important role.

End of Changes in Clause 11-13

Changes in Annex B

Annex B (informative): Overview of a ~~UMTS Network~~3GPP System

Figure B.1 presents an example of a ~~UMTS network~~3GPP System, related management areas and introduces some management interfaces. ~~UMTS~~ 3GPP Service specific entities are not shown.

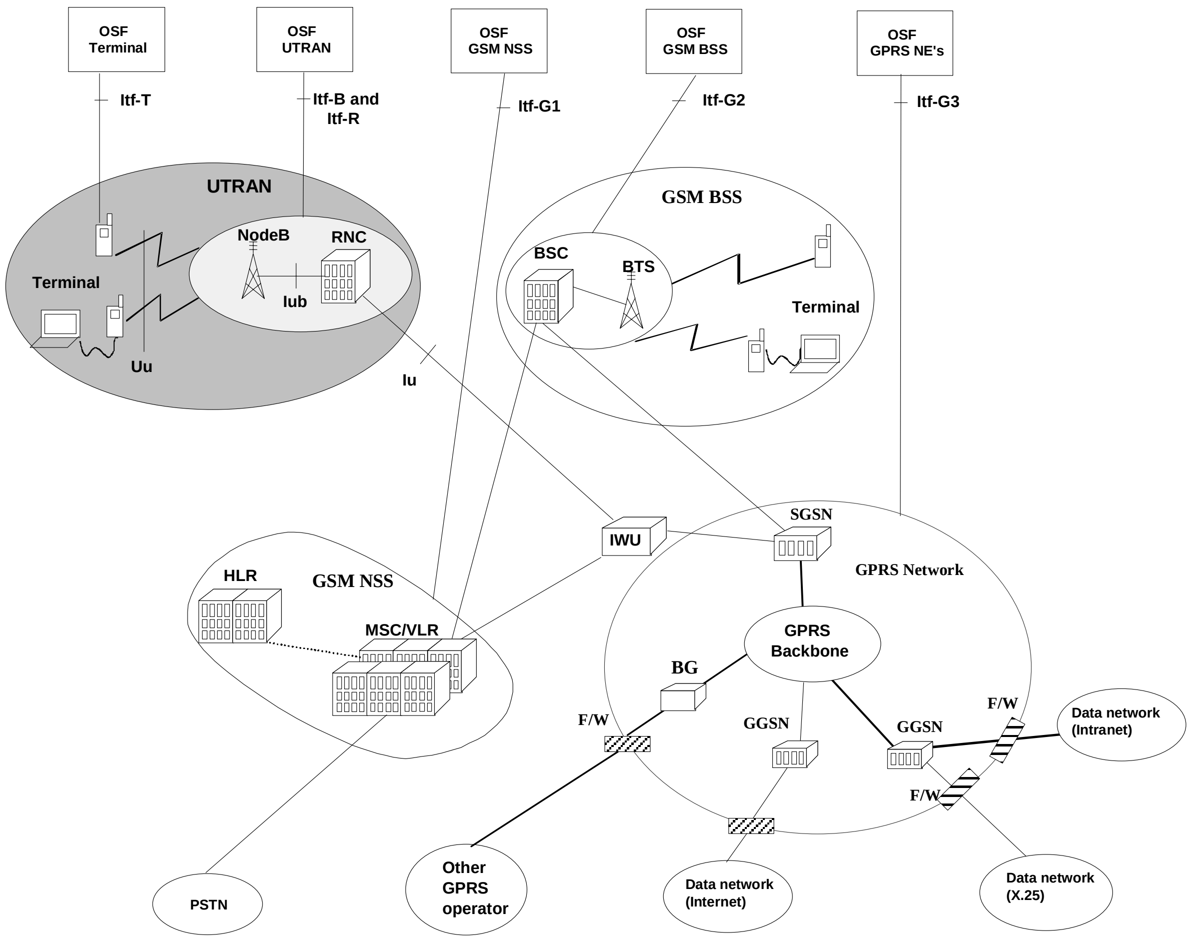

Figure B.1: Overview of a ~~UMTS Network~~3GPP System, showing management interfaces and management areas

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

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

End of Changes in Annex B

Annex H (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 1999	S_06	SP-99578	--	--	Approved at TSG SA #6 and placed under Change Control	-	3.0.0
Mar 2000	S_07	SP-000015	001	--	resolving remaining R99 inconsistency between 32.101 & 32.102	3.0.0	3.1.0
Mar 2000	S_07	SP-000015	002	--	Correction of IRP-related terminology	3.0.0	3.1.0
Mar 2000	--	--	--	--	Cosmetic	3.1.0	3.1.1
Jun 2000	S_08	SP-000227	003	--	Clarification of compliance conditions	3.1.1	3.2.0
Jun 2000	S_08	SP-000228	004	--	Update ITU-T TMN related reference material	3.1.1	3.2.0
Jun 2000	S_08	SP-000229	005	--	Definition of the Mandatory/Optional/Conditional qualifiers used in the IRPs	3.1.1	3.2.0
Jun 2000	S_08	SP-000230	006	--	Correction of erroneous editing and usage of undefined term	3.1.1	3.2.0
Mar 2001	S_11	SP-010026	007	--	Add UMTS TMN conformance	3.2.0	4.0.0
Jun 2001	S_12	SP-010232	008	--	Correction of ITU-T TMN concerns	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	009	--	Alignment with 3GPP drafting rules regarding headings	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	010	--	Update of TM architectural aspects	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	011	--	General clarifications and enhancements	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	012	--	Alignment with 3GPP drafting rules regarding verbal forms for the expression of provisions	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	013	--	Update and clarify compliance condition for a UMTS entity	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	014	--	Delete OSA definition	4.0.0	4.1.0
Jun 2001	S_12	SP-010232	015	--	Enhancements of the IRP Concept	4.0.0	4.1.0
Sep 2001	S_13	SP-010466	016	--	Update and alignment of compliance conditions for UMTS Management Physical architectures	4.1.0	4.2.0
Sep 2001	S_13	SP-010522	017	--	Specify the Rule for IDL file names	4.1.0	4.2.0
Mar 2002	S_15	SP-020037	018	--	Add the rule on how all SA5 Solution Set specifications indicate a reference to a particular SA5 Information Service specification.	4.2.0	5.0.0
Mar 2002	S_15	SP-020037	019	--	Inclusion of the IMS in the 3G Telecom Management Architecture (32.102)	4.2.0	5.0.0
Sep 2002	S_17	SP-020450	020	--	Correction of diagrams describing entities of the mobile system to be managed	5.0.0	5.1.0
Sep 2002	S_17	SP-020450	021	--	IS Template Changes to support new UML Repertoire/Methodology	5.0.0	5.1.0
Sep 2002	S_17	SP-020450	022	--	Addition of 3GPP UML Repertoire for IRP: IS	5.0.0	5.1.0
Sep 2002	S_17	SP-020479	023	--	Add optional parameters in CORBA Solution Set IDLs	5.0.0	5.1.0
Dec 2002	S_18	SP-020726	024	--	Aligning IRP related terminology with SA5's SWGC IRP specifications (32.6xy)	5.1.0	5.2.0
Dec 2002	S_18	SP-020727	025	--	Updates and corrections to Integration Reference Points (IRPs) Introduction	5.1.0	5.2.0
Mar 2003	S_19	SP-030061	027	-	Add New Subclause to IS Template for Notification Related IOCs	5.2.0	5.3.0
Sep 2003	S_21	SP-030402	029	--	Correction of subclause X.2.1 in Annex C	5.3.0	5.4.0
Sep 2003	S_21	SP-030403	030	--	Expansion to UML repertoire to support more concise modelling of stage 2 specifications	5.4.0	6.0.0