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Technical Specification

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3G Telecom Management principles and high level requirements

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To be drafted by the 3GPP secretariat

Foreword

To be drafted by the 3GPP secretariat

Introduction

1   Scope

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

In particular, the present document identifies and/or defines:

-    the high level requirements of a UMTS Management System

-    the reference model, showing the elements the UMTS Management System interacts with

-    the network operator processes needed to run, operate and maintain a UMTS network

-    the functional architecture of the UMTS Management System

-    the principles to be applied to UMTS Management Interfaces

-    the methodology to be followed in further steps of the UMTS Management Specifications

The present document does not provide physical architectures of the UMTS Management System.

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

2   References

2.1   Normative references

[1]   ITU-T Recommendation M.3010 (1996): "Principles for a telecommunications management network".

[2]   3GPP 22.01 "Universal Mobile Telecommunication System: Service Aspects; Service Principles (V3.2.1)"

2.2   Informative references

[3]   NMF GB910. NMF Telecom Operations Map (Draft 0.2b)

3   Definitions, symbols and abbreviations

3.1   Definitions

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

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

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

3.2   Symbols

3.3   Abbreviations

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

CEIR	Common Equipment Identification Register
CPE	Customer Premises Equipment
MMI	Man-Machine Interface
QoS	Quality of Service
SLA	Service Level Agreement
VHE	Virtual Home Environment

4   General

4.1   UMTS

4.1.1   Requirements

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

1) To be capable of managing equipment supplied by different vendors including the management systems themselves.

2) To minimise the complexity of UMTS management.

3) To build UMTS Network Management according to the principles of the TMN framework.

4) To provide the communication between UMTS Network Elements and UMTS Management Systems or between UMTS Management Systems themselves via standardised interfaces (e.g. Q3, CORBA, SNMP, etc.) as appropriate and necessary.

5) To minimise the costs of managing a UMTS network such that it is a small component of the overall operating cost.

6) To provide UMTS configuration capabilities that are flexible enough to allow rapid deployment of services.

7) To report events and reactions in a common way in order to allow remote control.

8) To simplify maintenance interventions by supporting remote maintenance operations.

9) To allow interoperability between Network Operators/Service Providers for the exchange of management/charging information. This includes interoperability with other networks and services (e.g. ISDN/B-ISDN, PSTN, UPT) as well as other UMTS networks.

10) To enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and grow as needed, both in size and complexity.

11) To re-use existing relevant standards (eg GSM. IN, ISDN/B-ISDN etc.) where necessary

12) To support and control the management of the security aspects in UMTS (e.g. key management, access control management, operation and administration of security mechanisms.

13) To provide and support a flexible billing and accounting administration, to support charging across UMTS and non-UMTS systems.

14) To address the management and assessment of system performance and operation through the use of common measurements, etc. This would enable a Network Operator/Service Provider to assess actual performance against planned targets.

15) To expose any information only once.
(Example: In case an OSS operator would like to change the frequency of one carrier in a cell: Then all occurrences of this frequency in this OSS, e.g. transceiver frequency, hand-over relationships, performance measurements, frequency hopping control, etc., should be changed by one action only.)

16) To support the restoration of a UMTS Management System (e.g. Back-up/Restore, Undo, Transaction log, etc.).

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

4.1.2   UMTS Reference Model

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

- 1 or more Access Networks, using different types of access techniques (GSM, UTRA, DECT, PSTN, ISDN, ...)

- 1 or more Core Networks, service specific or not, (GSM, UMTS, ISDN, IP, ATM ...)

- 1 or more Intelligent Node Networks, service logic and mobility management, (IN, GSM ...)

- 1 or more transmission networks (PDH, SDH etc) in various topologies (point-to-point, ring, point-to-multipoint...) and physical means (radio, fiber, copper ...)

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

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

- service support transparent to the location, access technique and core network, within the bearer capabilities available in one particular case

- user to terminal and user to network interface (MMI) irrespective of the entities supporting the services required (VHE)

- multimedia capabilities

4.1.3   UMTS Provisioning Entities

3GPP 22.01 – "Service Aspects; Services Principles" identifies two major entities which cover the set of UMTS functionality's involved in the provision of the UMTS services to the user. These are:

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

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

4.1.4   UMTS Management Infrastructure

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

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

- provides services to it's customers,

- needs an infrastructure to fulfil them (advertise, ordering, creation, provisioning, ...)

- assures them (Operation, Quality of Service, Trouble Reporting and Fixing, ...)

- bills them (Rating, Discounting, ...)

Not every UMTS Organisation will implement the complete Management Architecture and related Processes. Some processes may be missing dependent on the role a particular UMTS Organisation is embodying. Processes not

implemented by a particular UMTS Organisation are accessed via interconnections to other UMTS organisations, which have implemented these processes (called X-interfaces in the 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 NE's (Network Elements), and the interfaces between them (Q3, within one Operator Domain and X, between different Operators)

-    the methodology to define those interfaces

-    other architectural tools such as LLA (Logical Layered Architecture) that help to further refine and define the Management Architecture of a given management area

-    a number of generic and/or common management functions to be specialised/applied to various and specific TMN interfaces

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

-    UMTS incorporates other technologies to which TMN is not applied fully

-    UMTS faces new challenges that TMN does not address today

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

5   Architectural Framework

5.1   UMTS Management Reference Model

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

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

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

It is not the approach (nor it is possible) to re-define the complete management of all the technologies that might be used in the provision of UMTS. However, it is the intention to identify and define what will be needed from the perspective of UMTS management.
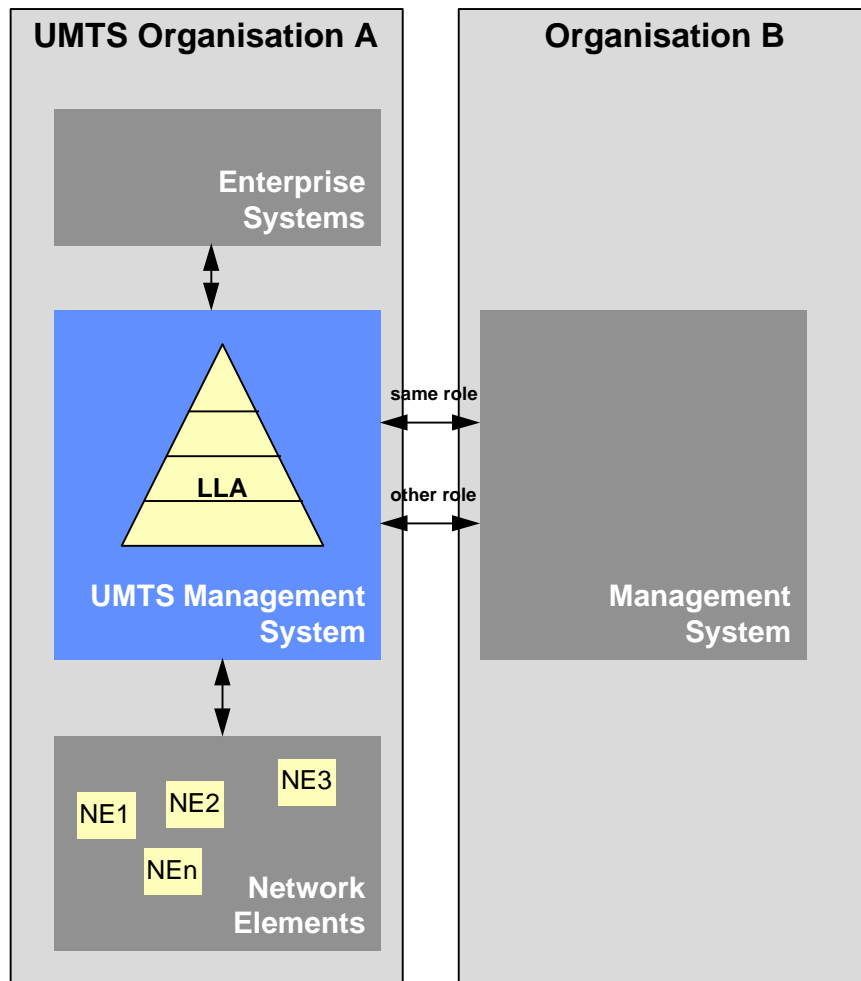
Figure 1. UMTS Management System Interactions

5.2   Interfaces to Enterprise Systems

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

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

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

5.3   Interfaces to NE's

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

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

It is assumed that this will not fully cover the OAM functionality of all NE types in UMTS at once, therefore a part of the functionality will be phased for further work and consideration, and some proprietary solutions (local and/or remote)

will be needed in the interim. The rational of that approach is not only lack of resources, but also to follow a pragmatic step-wise approach that takes into account the market forces (manufacturers and operators capabilities), defining clear and easy to consensuate steps that allow to have Management functionality implemented on the same time frame than the telecom functionality in the network (i.e. synchronise the management and network releases).

It is the approach to Management Interfaces to NE's to concentrate on information models, allowing the mapping to several protocol suites. The rational is:

- the blurring of Information and Telecommunication technologies in UMTS, it is required to work on a more open approach (acknowledging the market status and foreseen evolutions)

- the life-cycle of information flows is 10 to 20 years, while the protocols is 5 to 10 years

- the developments on automatic conversion allows for a more pragmatic and open approach

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

5.4   Interfaces to other Management Systems

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

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

- to other UMTS Management Systems (i.e. other from other UMTS operators)

- to other Management Systems (i.e. to non UMTS operators)

The first type deals with co-operation to provide UMTS services across a number of UMTS networks (e.g. roaming related interactions)

The second type deals with client-server relationship to other operators (e.g. to leased lines providers, to added value service providers etc).

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

6   UMTS Management Processes

The UMTS Management Framework document (TMN00044) [1], details the general aspects of a UMTS Management system. It also describes the management processes that collectively support Customer Care, Service Management and Network Management in a UMTS network.

These management processes are based on the widely accepted Telecom Operations Map from the TeleManagement Forum [3].

A diagram of these processes from [3] and [1] is included here to aid the reader.
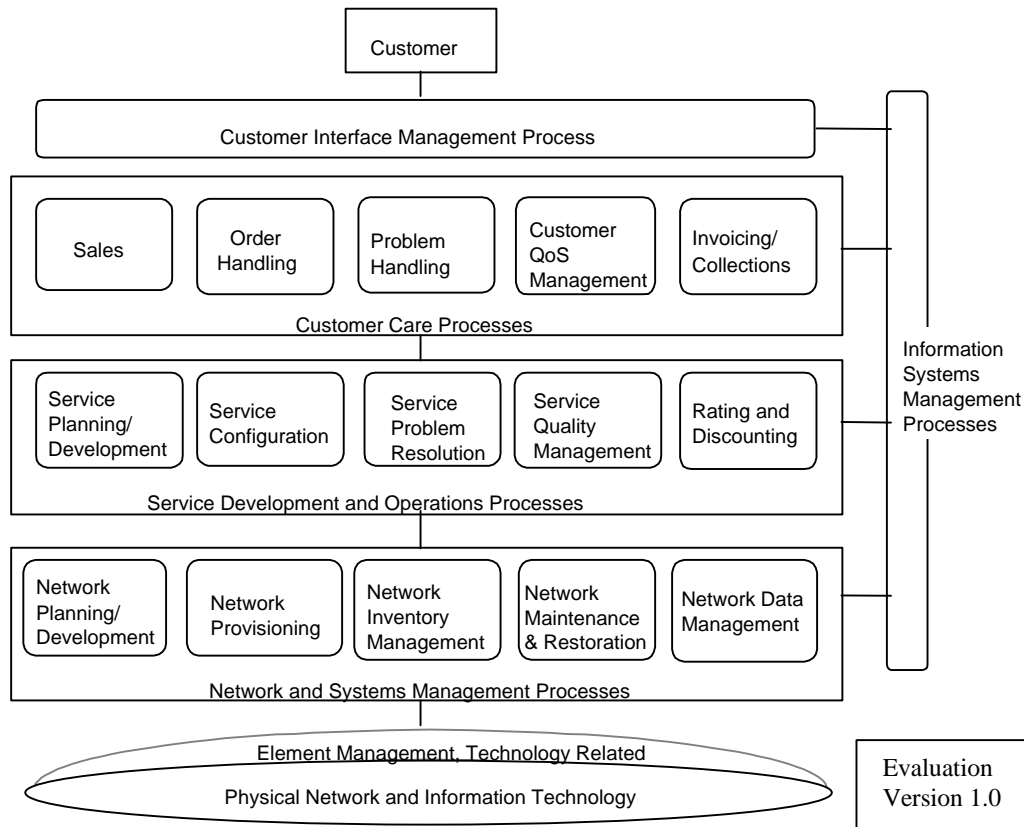
Figure 1: Telecom Operations Map Business Process Model (* imported from [3])

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

The management functions defined in [4] are:

- Fault Management

- Configuration Management (including Equipment Inventory)

- Performance Management (including Quality of Service Management)

- Roaming Management

- Accounting

- Customer Profile Management

- Service Deployment

- Fraud Management

- Security Management

- Software Management

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

7   Process Decompositions

This section will describe in more detail each of the UMTS management processes introduced in [1].

7.1   Customer Interface Management

The Customer Interface Management Process directly interacts with customers and translates customer requests and inquiries into appropriate "events" such as, the creation of an order or trouble ticket or the adjustment of a bill. This process logs customer contacts, directs inquiries to the appropriate party, and tracks the status to completion. In those cases where customers are given direct access to service management systems, this process assures consistency of image across systems, and security to prevent a customer from harming their network or those of other customers
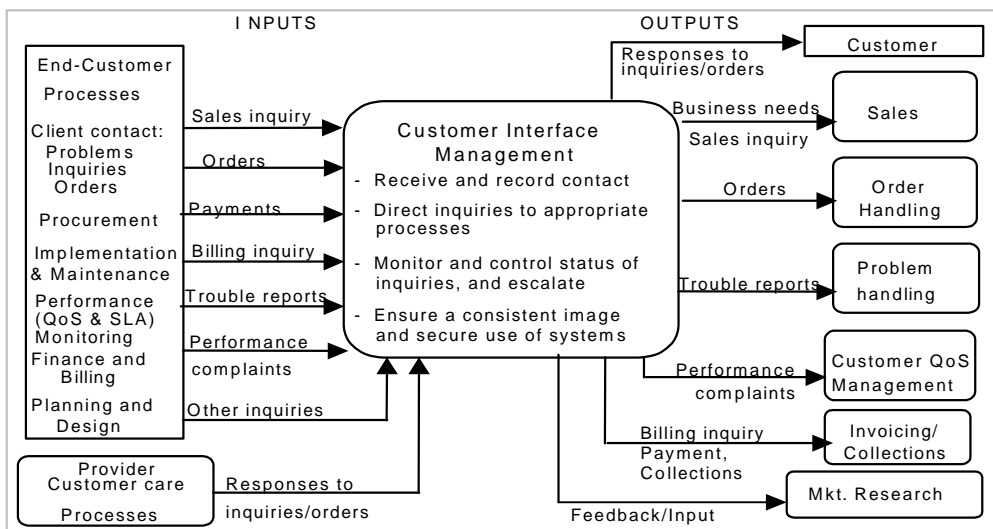
7.2   Sales

The Sales Process encompasses learning about the needs of each customer, and educating the customer about the communications services that are available to meet those needs. It includes working to create a match between the customer's expectations and the service provider's ability to deliver. Depending on the Service Provider process it can be purely selling or can include various levels of support. The Sales process may include pre-order work and interfaces. The aim is to sell the correct service to suit the customer's need and to set appropriate expectations with the customer. SLA negotiation, RFP (Request for Proposal) management and negotiation are led from this process.
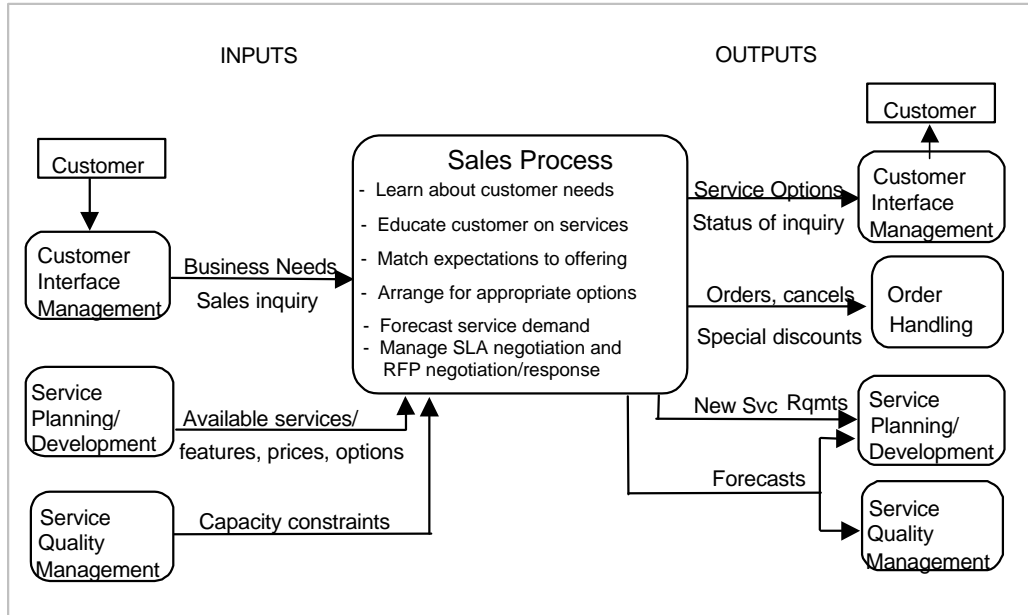
7.3   Ordering

The Ordering Process includes all the functions of accepting a customer's order for service, tracking the progress of the order, and notifying the customer when the order is complete. Orders can include new, change and disconnect orders for all or part of a customer's service, as well as cancellations and modifications to orders. Pre-order activity that can be tracked is included in this process. The development of an order plan may be necessary when service installation is to be phased in, and the need for preliminary feasibility requests and/or pricing estimates may be part of this process when certain services are ordered. The aim is to order the service the customer requested, support changes when necessary and to keep the customer informed with meaningful progress of their order, including its successful completion.

```
┌─────────────────────────────────────────────────────────────────────────────────┐
│                          INPUTS              OUTPUTS                              │
│  ┌──────────┐                                                  ┌──────────┐       │
│  │ Customer │                         Estimated Due Date       │ Customer │       │
│  └────┬─────┘                         Estimated Price          └────┬─────┘       │
│  ┌────▼─────┐                         Confirmed Due date       ┌────▼─────┐       │
│  │ Customer │          Orders/Cancels Order Status             │ Customer │       │
│  │ Interface│          Change requests Completion Notification │ Interface│       │
│  │Management│          Status inquiries                        │Management│       │
│  └──────────┘          Desired Due Date                        └──────────┘       │
│  ┌──────────┐                                                  ┌──────────┐       │
│  │  Sales   │                         Register QoS & SLA       │ Problem  │       │
│  └──────────┘                         terms, profiles          │ Handling │       │
│  ┌──────────┐ Credit Check  ┌─── Order ───┐ Required reports   └──────────┘       │
│  │ Credit   │ Response      - Accept orders QoS & SLA terms     ┌──────────┐      │
│  │ Bureau   │               - Determine pre-order feasibility   Completion│Customer QoS│
│  └──────────┘ Service       - Prep. price estimate, SLA terms  Notification│Management │
│  ┌──────────┐ order &       - Develop order plan                           │          │
│  │ Other    │ status        - Perform credit check             Service order ┌──────────┐
│  │Provider(s)│              - Request customer deposit          & status    │ Other    │
│  └──────────┘               - Initiate service installation                 │Provider(s)│
│  ┌──────────┐ Options       - Reserve nos.                     New/changed   └──────────┘
│  │ Service  │ Prices        - Issue order(s), track status     service notification┌──────────┐
│  │ Planning/│               - Complete order, notify customer  and activation │Invoicing/│
│  │Development│              - Initiate billing process                        │Collection│
│  └──────────┘                                                                 └──────────┘
│  ┌──────────┐ Feasibility                          Pre-service               ┌──────────┐
│  │ Service  │ Due date, Completion                 feasibility request       │ Service  │
│  │Configuration│                                   Activate service          │Configuration│
│  └──────────┘  Pre-order engineering/assignments                             └──────────┘
│  ┌──────────┐        ┌──────────┐                  Special discounts         ┌──────────┐
│  │ Network  │        │ Network  │                  Customer record details   │ Rating/  │
│  │ Planning/│        │Provisioning│                                          │Discounting│
│  │Development│       └──────────┘                                            └──────────┘
│  └──────────┘                                      Credit Check/ request     ┌──────────┐
│                                                                              │ Credit   │
│                                                                              │ Bureau   │
│  Service orders to other providers can be generated by the ordering process or by the
│  service configuration process, depending on the nature of the service ordered by the
│  customer.  They can also be generated from Network and Systems Management
│  processes when part of network infrastructure.                              └──────────┘
└─────────────────────────────────────────────────────────────────────────────────┘
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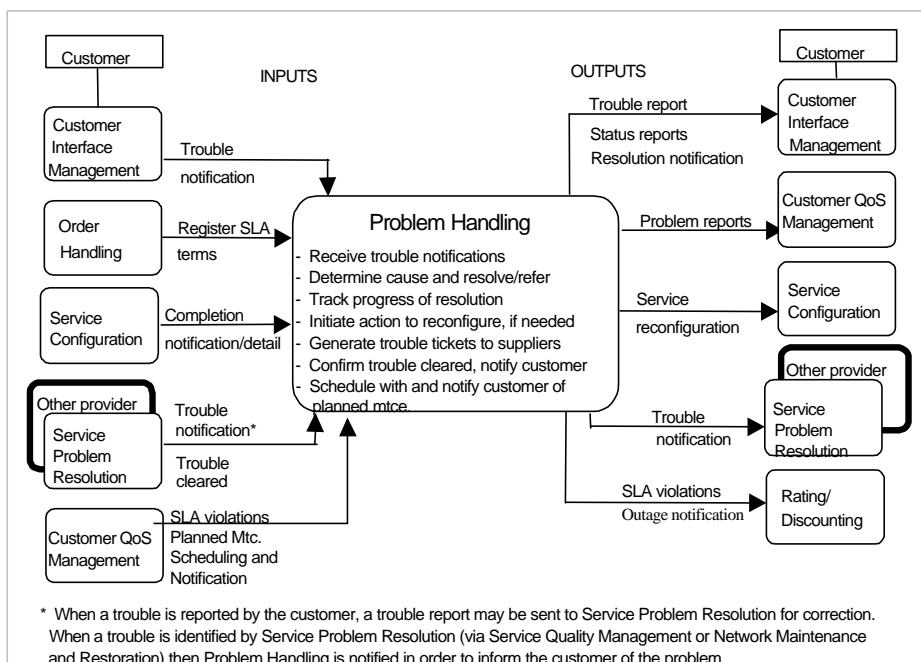
7.4   Problem Handling

The Problem Handling Process is responsible to receive service complaints from customers, resolve them to the customer's satisfaction and provide meaningful status on repair or restoration activity. This process is also responsible to be aware of any service-affecting problems, including

-    notifying the customer in the event of a disruption (whether reported by the customer or not)

-    resolving the problem to the customer's satisfaction

-    providing meaningful status on repair or restoration activity.

This proactive management also includes planned maintenance outages. The aim is to have the largest percentage of problems proactively identified and communicated to the customer, to provide meaningful status and to resolve in the shortest timeframe.

Customer | INPUTS | OUTPUTS | Customer

Problem Handling
- Receive trouble notifications
- Determine cause and resolve/refer
- Track progress of resolution
- Initiate action to reconfigure, if needed
- Generate trouble tickets to suppliers
- Confirm trouble cleared, notify customer
- Schedule with and notify customer of planned mtce.

* When a trouble is reported by the customer, a trouble report may be sent to Service Problem Resolution for correction. When a trouble is identified by Service Problem Resolution (via Service Quality Management or Network Maintenance and Restoration) then Problem Handling is notified in order to inform the customer of the problem.

7.5   Customer QoS Management

This process is concerned with UMTS Quality of Service (QoS) and its measurement, management and reporting. The definition of QoS for a particular UMTS service will be defined in Service Level Agreements (SLA's), and other service related documents.

The Customer QoS management process has been decomposed into its sub-processes in Figure 2 below.
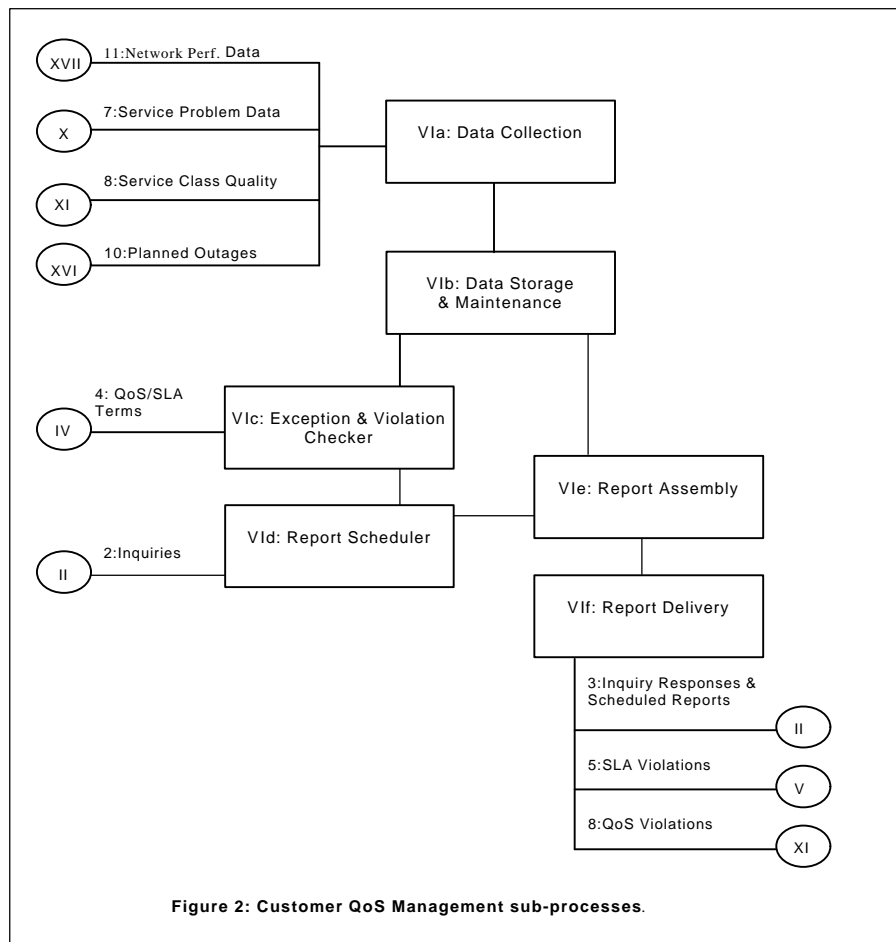
Figure 2: Customer QoS Management sub-processes

From a measurement perspective, Customer QoS management will receive via its **Data Collection** sub-process, network performance data, service performance data (problem and quality) and notification of planned outages, this data will relate to the "end to end" service and as such may be sourced from any networks employed to deliver the service.

From a management perspective the **Exception & Violation Checker** sub-process will compare the measurement data with SLA and QoS terms and targets.

From a reporting perspective the **Report Scheduler, Assembly and Delivery** sub-processes will report SLA /QoS violations and warnings to the Service Quality Management and Problem Handling UMTS management processes. Inquiry responses and scheduled reports will also be sent to the Customer Interface process.

A more detailed description of each sub-process is available in [<TMF Ref TBD>].

7.6   Invoicing and Collection

This process encompasses sending invoices to customers, processing their payments and performing payment collections. In addition, this process handles customer inquiries about bills, and is responsible to resolve billing problems to the customer's satisfaction. The aim is to provide a correct bill and, if there is a billing problem, resolve it quickly with appropriate status to the customer. An additional aim is to collect monies due the service provider in a professional and customer supportive manner.

Some providers provide invoicing and collections functions for other providers as a service.
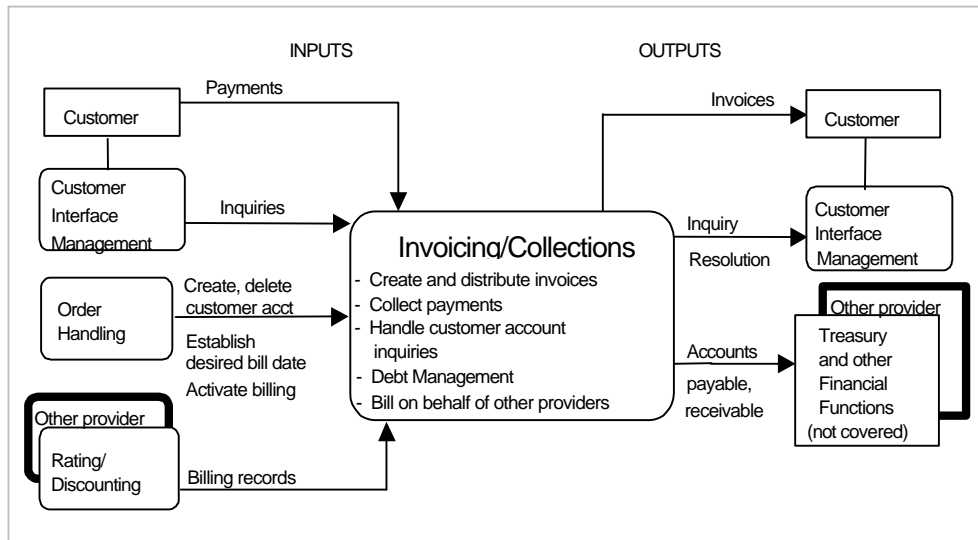
7.7   Service Planning and Development

This process encompasses:

-   Designing technical capability to meet specified market need at desired cost

-   Ensuring that the service (product) can be properly installed, monitored, controlled, and billed

-   Initiating appropriate process and methods modifications, as well as initiating changes to levels of operations personnel and training required

-   Initiating any modifications to the underlying network or information systems to support the requirements

-   Performing pre-service testing that the technical capability works and that the operational support process and systems function properly

-   Ensuring that sufficient capacity is available to meet forecasted sales.

The aim is rapid development and deployment of new services, service enhancements and/or capacity at specified cost , support and quality requirements.
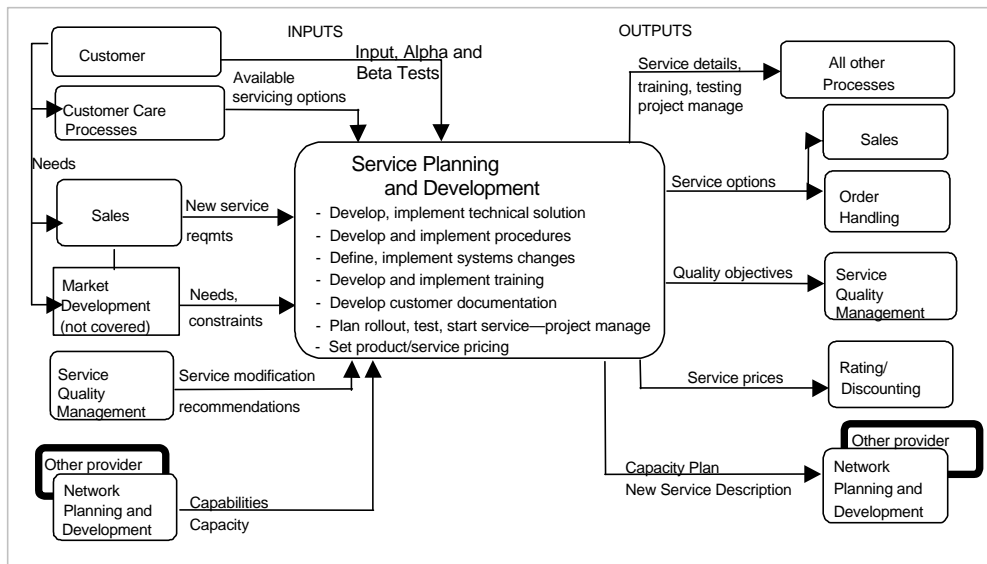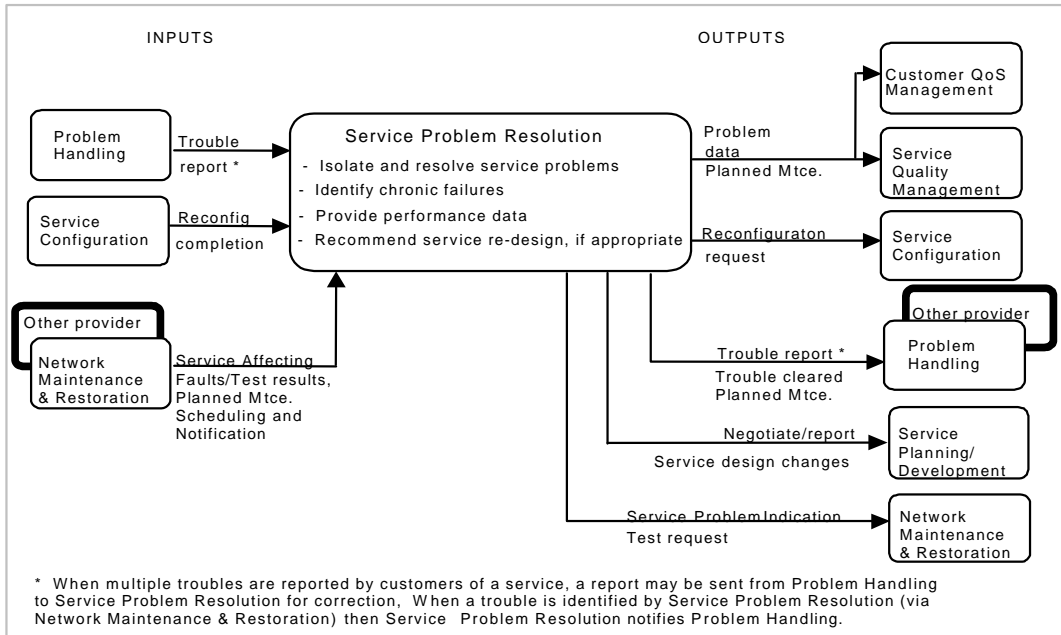
7.8   Service Configuration

This process encompasses the installation and/or configuration of service for specific customers, including the installation/configuration of customer premises equipment. It also supports the re-configuration of service (either due to customer demand or problem resolution) after the initial service installation. The aim is to correctly provide service configuration within the timeframe required to meet ever decreasing intervals.
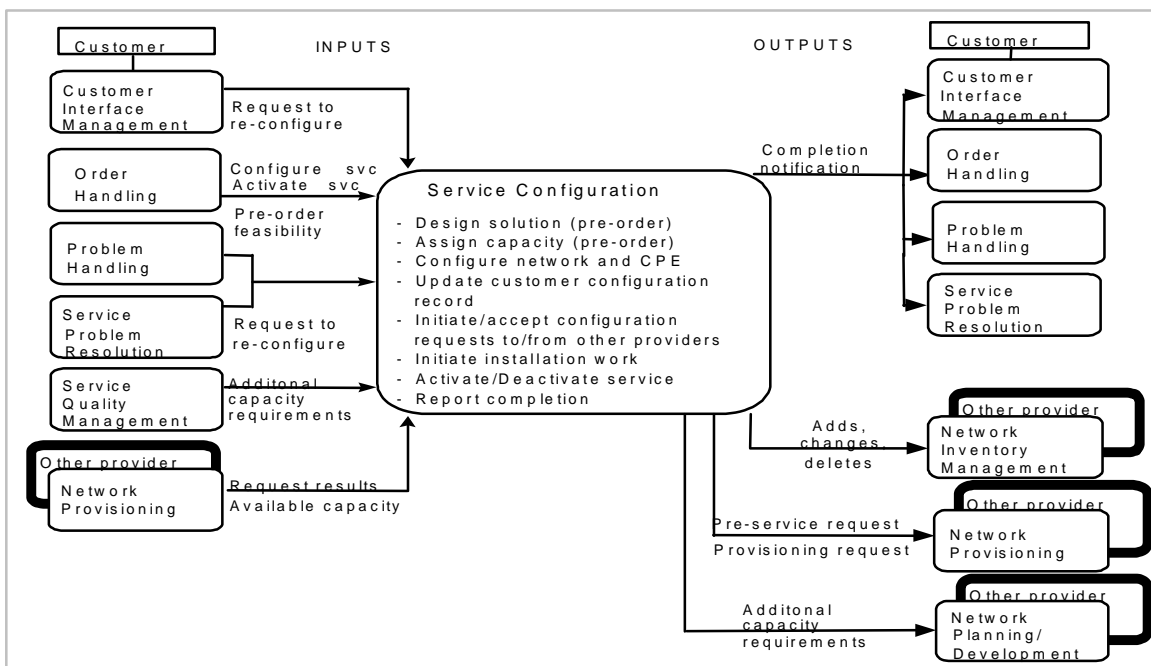
7.9   Service Problem Resolution

This process encompasses isolating the root cause of service affecting and non-service affecting failures and acting to resolve them. Typically, failures reported to this process affect multiple customers. Actions may include immediate reconfiguration or other corrective action. Longer-term modifications to the service design or to the network components associated with the service may also be required. The aim is to understand the causes impacting service performance and to implement immediate fixes or initiate quality improvement efforts.

```
                    INPUTS                                    OUTPUTS

 ┌──────────┐                ┌─────────────────────────────┐              ┌──────────────┐
 │ Problem  │  Trouble       │  Service Problem Resolution  │  Problem     │ Customer QoS │
 │ Handling │ ─────────────▶ │  - Isolate and resolve       │  data        │ Management   │
 └──────────┘  report *      │    service problems          │  Planned Mtce│ ┌──────────┐ │
                             │  - Identify chronic failures │              │ │ Service  │ │
 ┌──────────┐                │  - Provide performance data  │              │ │ Quality  │ │
 │ Service  │  Reconfig      │  - Recommend service         │  Reconfiguraton│ Management │
 │Configura-│ ─────────────▶ │    re-design, if appropriate │  request     │ ┌──────────┐ │
 │  tion    │  completion    └─────────────────────────────┘              │ │ Service  │ │
 └──────────┘                                                             │ │Configura-│ │
                                                                          │ │  tion    │ │
```

* When multiple troubles are reported by customers of a service, a report may be sent from Problem Handling to Service Problem Resolution for correction, When a trouble is identified by Service Problem Resolution (via Network Maintenance & Restoration) then Service Problem Resolution notifies Problem Handling.

7.10   Service Quality Management

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

-   Whether service levels are being met consistently

-   Whether there are any general problems with the service or product

-   Whether the sale and use of the service is tracking to forecasts.

This process also encompasses taking appropriate action to keep service levels within agreed targets for each service class and to either keep ahead of demand or alert the sales process to slow sales. The aim is to provide to provide effective service specific monitoring, to provide management and customers meaningful and timely performance information across the parameters of the specific service. The aim is also to manage service levels to meet SLA commitments and standard commitments for the specific service.
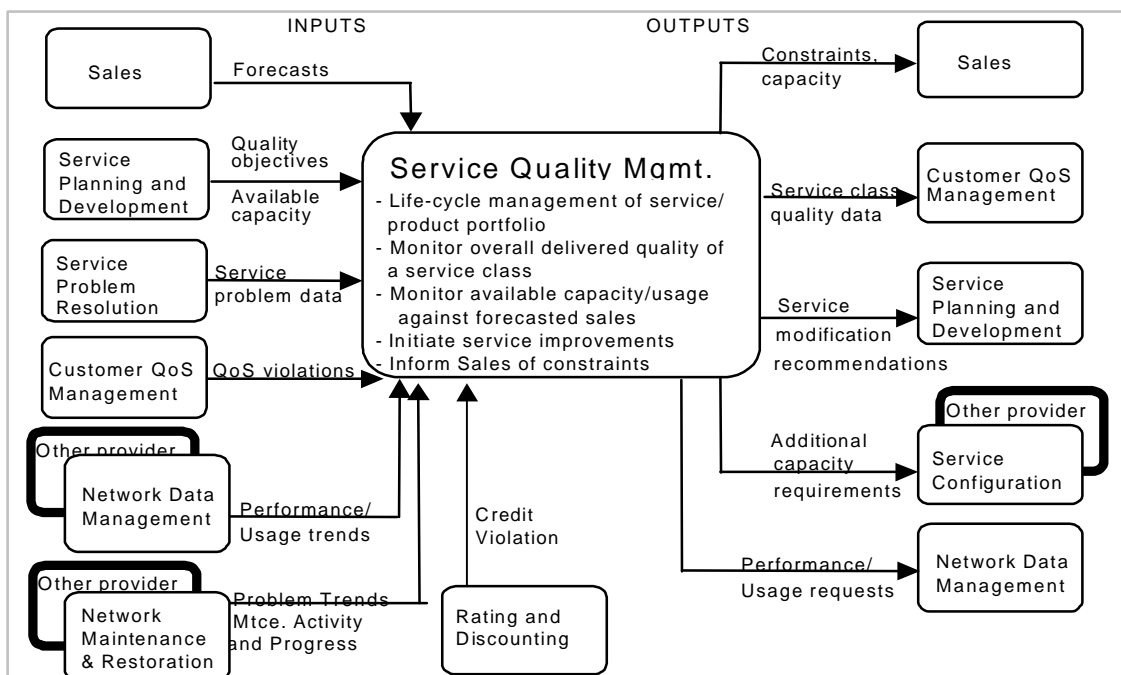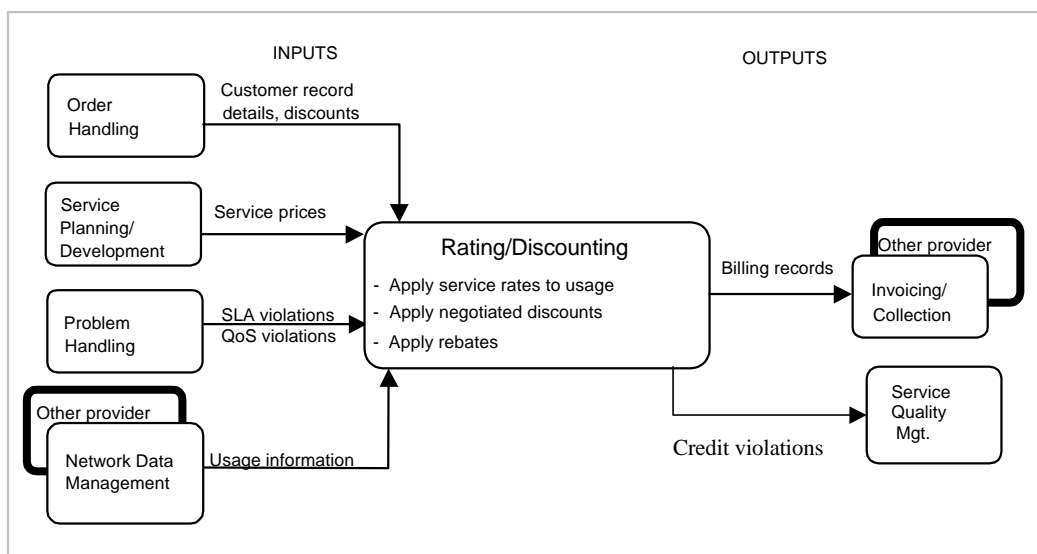
7.11   Rating and Discounting

This process encompasses

- Applying the correct rating rules to usage data on a customer-by-customer basis, as required

- Applying any discounts agreed to as part of the Ordering Process

- Applying promotional discounts and charges

- Applying outage credits

- Applying rebates due because service level agreements were not met

- Resolving unidentified usage

The aim is to correctly rate usage and to correctly apply discounts, promotions and credits.

7.12   Network Data Management

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

The Network Data Management process must provide sufficient and relevant information to Customer QoS Management to allow verification (compliance/non-compliance) of Service Level Agreements. The Service Level Agreements themselves are not known at the NML.

This process must ensure that the Network Performance goals are tracked, and that notification is provided when they are not met (e. g. threshold exceeded or performance degradation). This includes information on capacity, utilization and traffic. In some cases, changes in traffic conditions may trigger changes to the network for the purpose of traffic control. Reduced levels of network capacity can result in requests to Network Planning for more resources.

The Network Data Management process has been decomposed into its sub-processes in Figure 3 below.

A more detailed description of each sub-process is available in [6].

**Figure 3: Network Data Management sub-processes**.
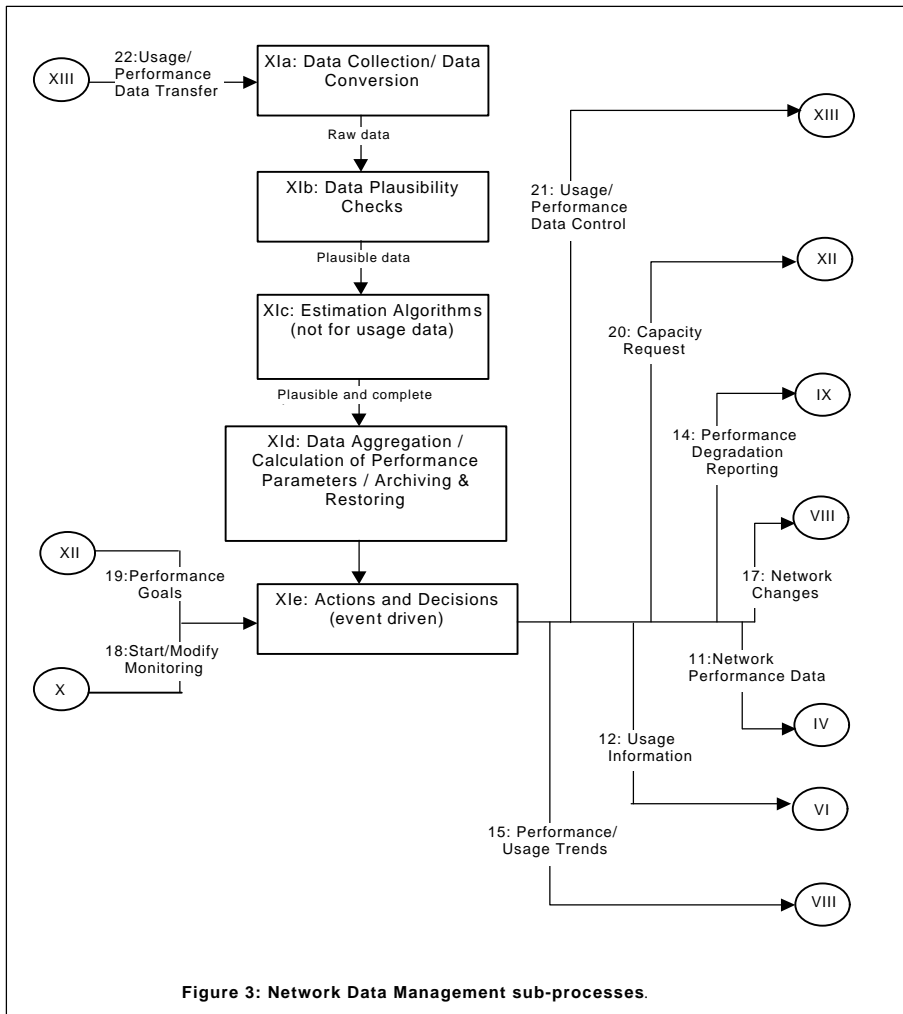
7.13   Network Maintenance & Restoration

This process encompasses maintaining the operational quality of the network, in accordance with required network performance goals. Network maintenance activities can be preventative (such as scheduled routine maintenance) or corrective. Corrective maintenance can be in response to faults or to indications that problems may be developing (proactive). This process responds to problems, initiates tests, does analysis to determine the cause and impact of problems, and notifies Service Management of possible effects on quality. The process issues requests for corrective actions.
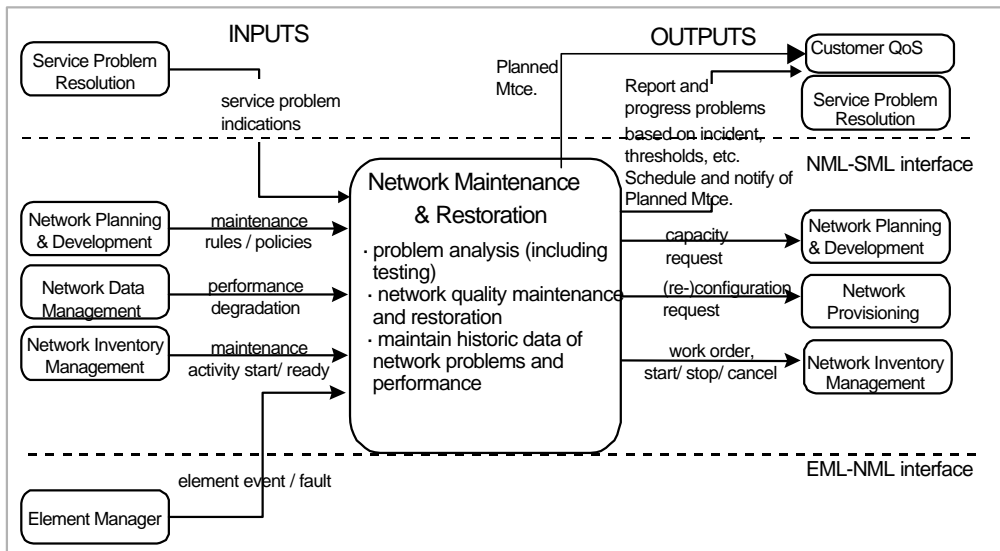
7.14   Network Inventory Management

This process encompasses anything to do with physical equipment and the administration of this equipment. The process is involved in the installation and acceptance of equipment, with the physical configuration of the network, but also with handling of spare parts and the repair process. Software upgrades are also a responsibility of this process.
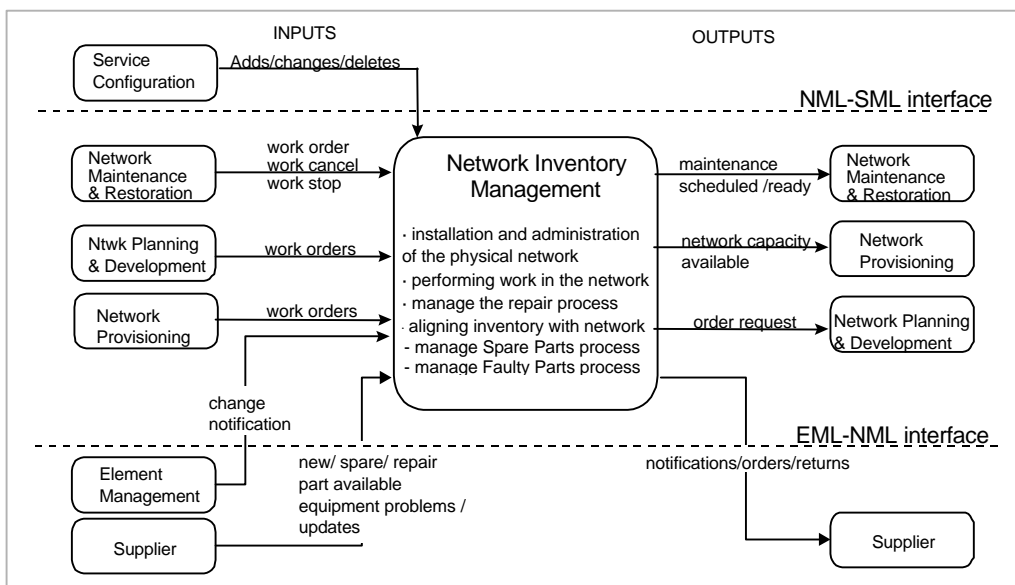
7.15   Network Provisioning

This process encompasses the configuration of the network, to ensure that network capacity is ready for provisioning of services. It carries out network provisioning, as required, to fulfill specific service requests, and configuration changes to address network problems. The process must assign and administer identifiers for provisioned resources and make them available to other processes.

Note that the routine provisioning of specific instances of a customer service (especially 'simple' services such as POTS) may not normally involve Network Provisioning but may be handled directly by Service Provisioning from a pre-configured set.
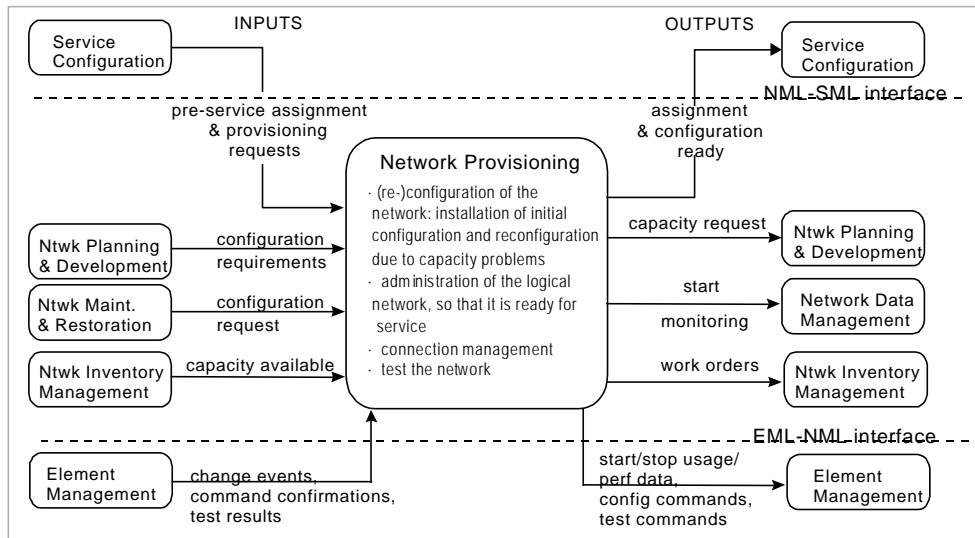
7.16   Network Planning and Development

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

This process also deals with designing the network capability to meet a specified service need at the desired cost and for ensuring that the network can be properly installed, monitored, controlled, and billed. The process is also responsible for ensuring that enough network capacity will be available to meet the forecasted demand and supporting cases of unforecasted demand. Based on the required network capacity, orders are issued to suppliers or other network operators (ONO's) and site preparation and installation orders are issued to the Network Inventory Management or a third party Network Constructor (work orders). A design of the logical network configuration is provided to Network Provisioning.
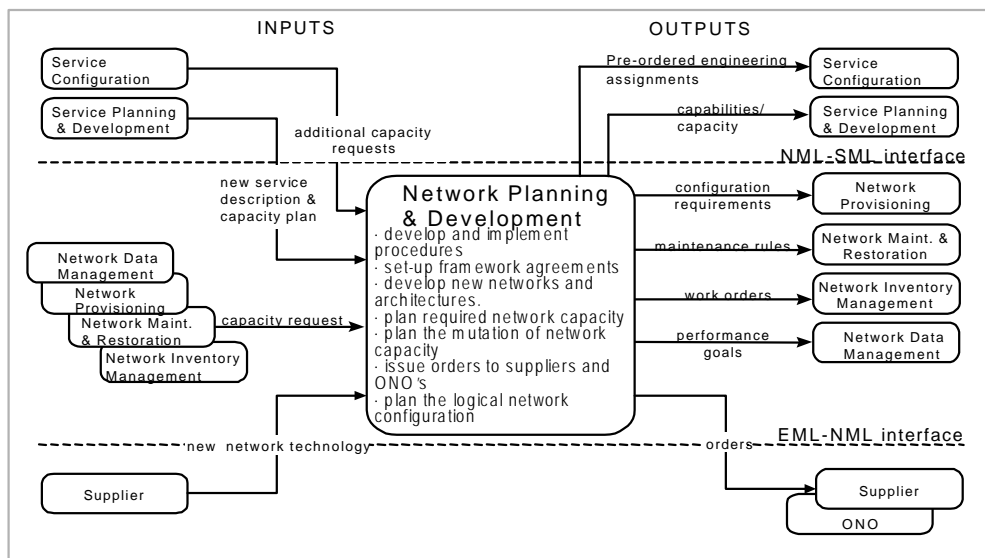
8   UMTS Management Functional Architecture

8.1   Performance Management

Figure 4 below makes a cut through the Telecom Operations Map from a Performance Management perspective. Although this "cut slice" is quite large it does not contain all and everything related to Performance Management. But it

contains all processes and interfaces mainly involved in Performance Management. To make the figure clearer different thickness' of lines have been used to illustrate the different importance of the accordingly marked interfaces.
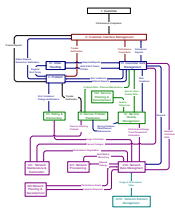

Figure 4: Information flow to support Performance Management

8.2   Roaming Management

This example describes a unique, for mobile networks, management task. Roaming is a service provided by mobile service providers where customers of a home service provider may use the infrastructure of another, a serving service provider (see figure 5). The idea is that a customer receives the same service when it roams in another network, as it would receive at home.
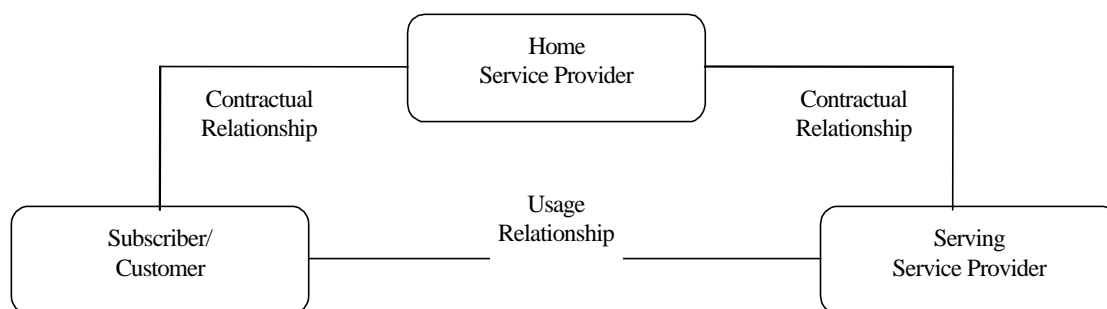
Figure 5: Relationships between Subscriber, Home and Serving Service Provider

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

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

- Tariffing and pricing;

- Signaling and traffic interconnection;

- CDR exchange format and exchange schedule;

- Problem handling; and many others.

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

The handling of this complex process requires an excellent understanding of roaming agreement management. To aid this understanding figure 6 below is provided. All information flows, which are not effected or not changed by roaming agreement management, have been omitted to aim readability.

   Note: The information flows shown in figure 6 are intended to illustrate the flow of management information
   required to support roaming in 3rd Generation networks.

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

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

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

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

1. Customer care information flow (solid line)
    This is the major information flow supporting all contract related activities: negotiating tariffs, negotiating SLAs, trouble handling, roaming accounting file exchange, ...

2. New service facilities information flow (dash-dotted line)
    This is an optional supporting flow which takes place if the support of an roaming agreement requires the introduction of new services or a configuration change of existing services.

3. New network facilities information flow (dashed line)
    This is an optional supporting flow which takes place if the support of an roaming agreement requires the introduction of new network facilities or a configuration change of existing network facilities.

Figure 6: Information flow to support Roaming Management
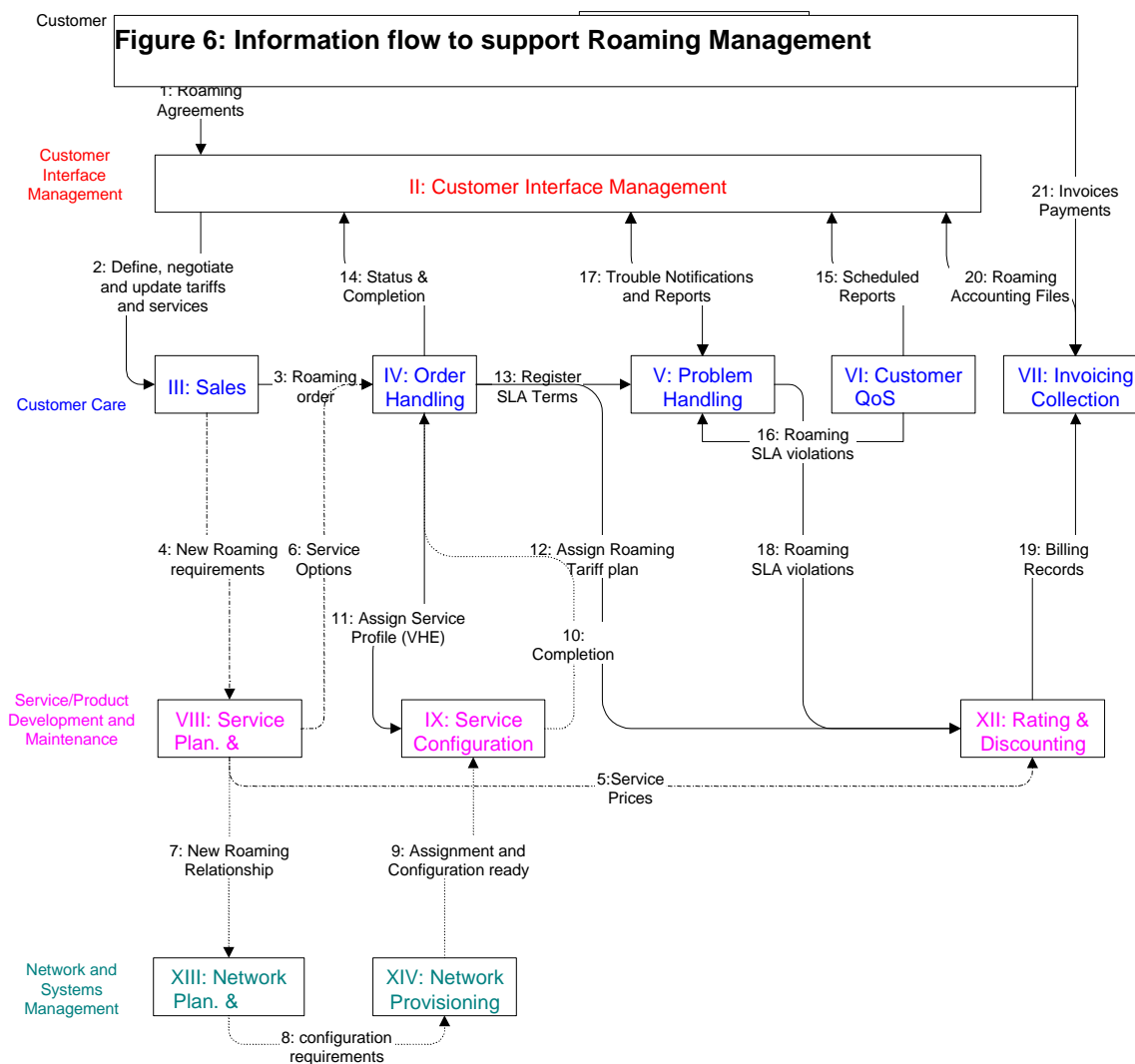
8.3   Fraud Management

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

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

- classification of customers according to levels of fraud risk (based on demographic and credit information)

- revision of the fraud risk level (based on usage information, payment behavior, ... near real time or off-line)

- detection of fraud patterns (in real time or near real time)

- taking the appropriate actions to suspend service provision, even if the customer is using a different network than its home (the customer is roaming)

- for visitor customers (i.e. roamers) it may consult the home provider and/or international repositories (e.g. the Central Equipment Identity Register – CEIR for GSM mobile equipment)

Fraud management is present in several processes of the Telecom Operations Map. Figure 7 below shows the occurrence of fraud detection and fraud prevention functions listed above to the existing processes of the Telecom Operations Map.
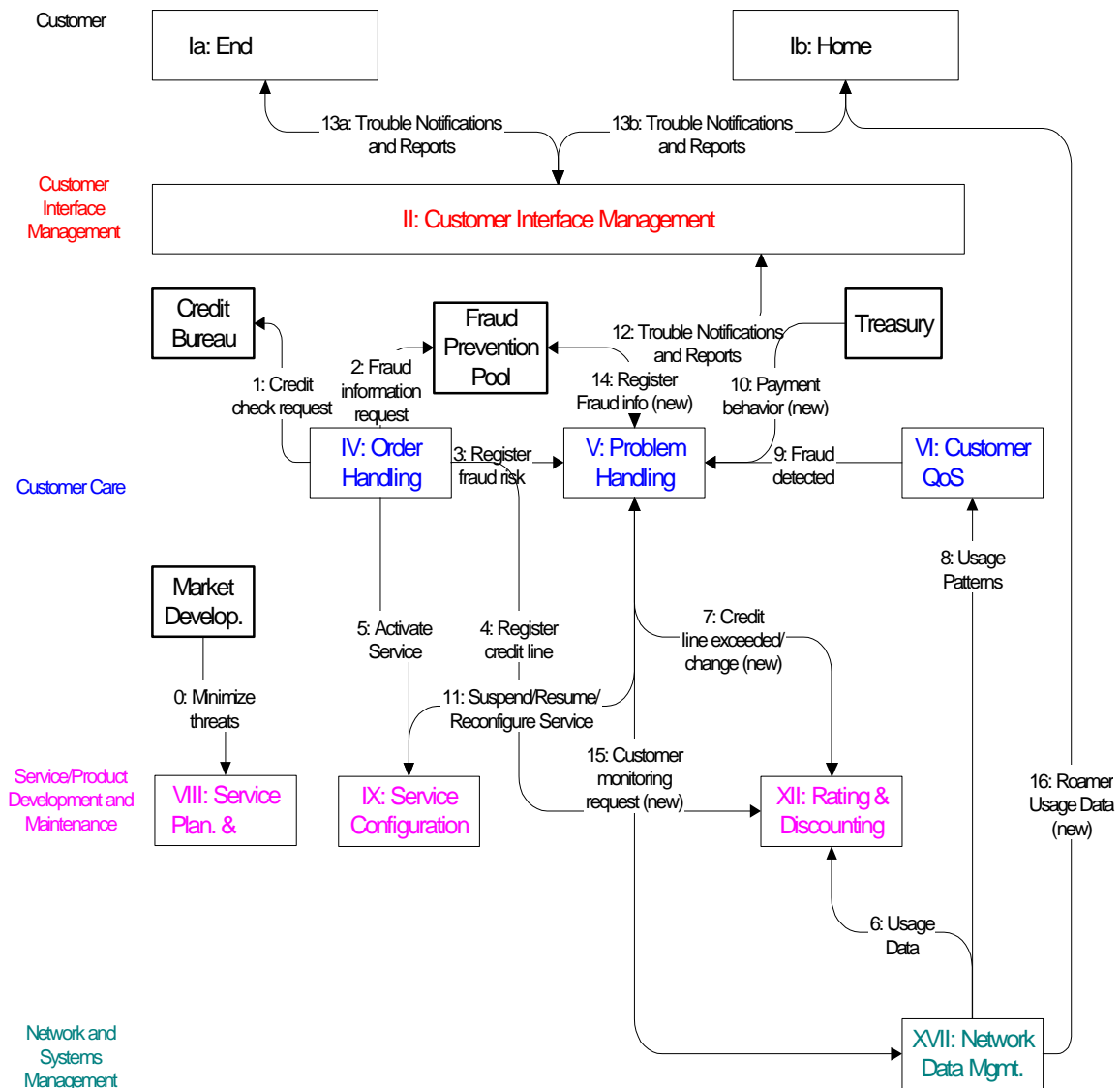
Figure 7: Information flow to support Fraud Management

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

Although it seems that all required functions to support fraud management exist in the Telecom Operations Map, fraud management requires the introduction of some new interfaces (marked accordingly in figure 7) to be efficient.

Pre service: prevent fraud

(0) Potential threats and leaks should be analyzed during Service Planning and Design and the service should be optimized to be as resistant to threats as possible.

Fulfillment: prevent fraud

(1) Order Handling initiates the classification of customers according to levels of fraud risk. This includes a credit check request; and

(2) A retrieval of fraud information from a fraud prevention pool (if available).

(3) The determined initial fraud risk level will be registered at Problem Handling.

(4) A credit line depending on the customer's fraud risk level will be registered at Rating & Discounting.

(5) Finally the ordered Service will be activated fully or partly depending on the fraud risk level.

Assurance 1: detect fraud

(6)   Normal usage data (preferably hot billing usage data) is transferred to Rating and Discounting.

(7)   Rating & Discounting checks billing records for exceeding established credit lines and reports this Problem Handling (new).

Assurance 2: detect fraud

(8)   Usage data/patterns are sent to the Customer QoS Management for analysis.

(9)   If Customer QoS Management detects a fraud then it sends an according notification to Problem handling which can decide on appropriate actions to take in order to prevent or stop fraud.

Assurance 3: detect fraud

(10) Treasury informs Problem handling about the payment behavior of customers.

Assurance 4: stop fraud

(11) Problem Handling can decide on appropriate actions to take in order to prevent or stop fraud by reconfiguring the service; and/or

(12) contacting via Customer Interface Management

(13) The Customer (either the end-customer or the home service provider in case of a visiting customer).

Assurance 5: prevent fraud

(14) Problem handling may register fraud information in the Fraud Prevention Pool.

Assurance 6: stop roaming fraud

(15) Problem handling requests the monitoring of a visiting customer on a trouble notification request of its home service provider according to the roaming agreement.

(16) Network Data Management delivers the usage data to the requesting home service provider.

8.4   Fault Management

8.5   Security Management

<Introduction of IP Network elements in UMTS will have major impact on Security Management as has been the case with GPRS>

8.6   Software Management

8.7   Configuration Management (including Equipment Inventory)

<TBD Identify critical inventory information within the Operators environment.>

8.8   Customer Profile Management

<This is a HLR type management function, how does Virtual Home Environment (VHE) affect this management area? >

8.9   Service Deployment Management

8.10   Accounting Management

9   UMTS Management Interfaces

All management interfaces in UMTS, namely:

-   between the NEs and the Management System of a single UMTS Organisation

    between Management Systems of different UMTS Organisations

-   within the Management System of a single UMTS Organisation

-   between the Management System and the Enterprise Systems of a single UMTS Organisation

can be studied from four different perspectives or levels:

-   logical (information model and flows used in the relationship manager-agent, or equivalent)

-   application protocol (end to end, upper layers protocol running between manager-agent, or equivalent)

-   networking protocol (lower layer protocols carrying the information in/out the manager and agent, or equivalents)

-   physical (mapping of the manager and agent, or equivalents, roles into physical entities)

9.1   Logical Level

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

Interactions at this level are fully standardised by 3GPP in terms of Information Models (static information definition, in a language as protocol neutral as possible) and Information Flows (dynamic aspects).

9.2   Application Protocol Level

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

The Application Protocol Suite used for the interaction between entities across a given interface is optional within the valid UMTS Management Application Protocol Suites (see Annex A for a list of UMTS Management Protocol Suites). In some cases, one of those protocol suites will be recommended as preferred protocol suite

9.3   Networking Protocol Level

Whatever standardised protocol suite at the networking level that is capable of meeting the functional and operational requirements (including the network addressing aspects) of the Logical and Application Protocol levels of a given UMTS management interface, is a valid Networking Protocol for that interface. No further standardisation will be defined within 3GPP, in order to allow market to influence on this point.

9.4   Physical Level

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

This specification does not preclude the usage of Q-Adapters at other interfaces of the UMTS Management.

9.5   Compliance Conditions

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

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 valid Application Protocols specified by 3GPP UMTS Application Protocols for that interface

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 must be provided. This Q-Adapter must be provided independently of any other UMTS NE and/or UMTS Management System.

10   Methodology

10.1   Documentation

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

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

Defined by this document.

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

10.2   Tools and Methods

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

Annex A (normative):UMTS Management Application Protocols

The valid Management Application Protocols for UMTS are:

- CMIP

- SNMP

- CORBA IIOP

Further developments on the Application Protocols applicable to management will be monitored and eventually accepted.

The valid Bulk Transfer Application Protocols are:

- FTAM

- ftp

- tftp

History

Document history		
0.0.0	19/04/1999	Draft based on ES 201 385 V1.1.1 (1999-01)
1.0.0	26/04/1999	Draft as submitted to TSG SA Plenary (minor editorial work done to align styles with 3GPP style sheet, but otherwise identical to version 0.0.0)