

**The Internet Generation
Customer Care & Billing System**

Product Description

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1 Acronyms

ADSL	Asymmetric Digital Subscriber Line
API	Applicative Program Interface
CCB	Customer Care and Billing
CCR	Customer Care Representative
CDR	Call Data Record
CORBA	Common Object Request Broker Architecture
CSR	Customer Service Representatives
CTI	Computer Telephony Integration
DSLAM	Digital Subscriber Line Access Multiplexer
FSM	Finite State Machine
GUI	Graphical User Interface
HTML	HTTP Text Markup Language
IDL	Interface Description Language
IOP	Internet Inter Orb Protocol
ISP	Internet Service Provider
IT	Information Technology
LDAP	Lightweight Directory Access Protocol
MIB	Managed Information Base
NAS	Network Access System
OO	Object Oriented
SIMS	Sun Internet Mail Server
SP	Service Provider
TMF	TeleManagement Forum

2 Introduction

SMARTEN is an Integrated Service Management software platform based on Telemanagement Forum (formerly Network Management Forum) endeavors regarding the standardization of the Service Provider (SP) business processes. By leveraging the performance and scalability of multithread products (Java, IONA, Orbix and Versant Object Oriented Management System) and the flexibility of its internal design, SMARTEN allows:

- End-to-End management of services through its modules, Base System, Customer Care, Accounting, Rating and Billing;
 - Customization of specific business needs to blueprint different business model and marketing strategies;
 - Easy integration with legacy systems and applications;
 - Complete Self-Care features;
-

- Complete support of Directory Enabled Networks and Applications through its LDAPV3 interface to stored data.

From a technological standpoint SMARTEN has been designed to achieve maximum flexibility, scalability and open architecture in order to manage the complexity of the Service Management applications.

Key issues are:

- Functional System Requirement based on standards (TMF);
- Object Oriented Analysis and Design;
- Object oriented Database;
- Distributed Objects Architecture (CORBA);
- User Interfaces based on Web technologies (Java Applet, Java Beans and HTML).

The result is a highly customizable and scalable system, easily distributed throughout various platforms and easily integrated with external systems.

3 SMARTEN Win Themes

The inception phase of SMARTEN is based on the following guidelines which highlight the competitive advantages of SMARTEN compared to its competitors.

- Adapting the *zero development approach*, an impressive abatement of the time to market phase is achieved. In SMARTEN the GUIs are completely active which implies that no single part of a GUI is codified. Due to the *metamodelling* potential, advanced by the OO database, any single piece of information in the GUI is retrieved from the database itself, even the labels. Additional information is furnished in the following chapters.
- The *customer direct access approach* cuts additional costs of a Call Center. SMARTEN considers the client the end-user as the operator himself, allowing him direct access to his data by means of appropriate web interfaces hence reducing the need of complex call centers. In addition to the Billing-on-Line features, it is possible to access one's own personal, business and contract data, permitting the client to exploit SMARTEN for commercial purposes by inserting banners in the web pages.
- Additional integration costs are dramatically cut through the *total openness approach*. Differently from other competing products, SMARTEN did not stem from a project but was conceived immediately as a product and any design attempt was made exclusively to render the

product accessible to the IT world. Special attention is given to CORBA and LDAP standards, open platforms(Unix), and possible customizations. Tailor-fit customizations are achieved through the use of SMARTEN Java Beans by means of tools such as VisualCafe or Jbuilder or by directly integrating at the business object tier by means of the IDL interface. Both the Java Beans and IDL are public and therefore accessible to all SMARTEN customers.

- Hardware requirements are minimal due to the *total scalability approach*. The use of CORBA permitted the development of SMARTEN as a set of software modules capable of interacting through standard IIOP (Internet Inter Orb Protocol). Each individual module therefore is defined by an interface specified by IDL (Interface Definition Language) language and therefore can be a resident on any computer which possesses a TCP/IP socket. This feature allows the possibility to completely integrate Unix (Solaris, HP-UX etc...) systems with Windows NT or even Windows 95. In this manner, one can opt to distribute resource critical components (ex. rating, billing) on fault-tolerant systems while others, less prone to failure, on more economical hardware. The use of multithreading in all SMARTEN components provides vertical scalability on multiple CPU systems.

4 SMARTEN Business Processes

SMARTEN was designed to sustain a set of features and generic business processes created on a detailed analysis project drawn up by TeleManagementFORUM (www.tmforum.org).

TeleManagementFORUM is a *non-profit* organization founded by the largest TLC producers, software vendors and 1st tier operators in order to define the operational processes which a service provider should offer in order to maximize success in such a complex market.

Due to complete product adherence by way of the TMF definition and OO architecture, SMARTEN is capable of distributing its assets both in a Business to Consumer and Business to Business context.

4.1 Metamodelling

Viewed from a totally abstract perspective, SMARTEN Business Object Tier hosts the application logic necessary for the class objects in the real world - contracts, services, customers, and company organizations - to interact with one another.

No hypothesis is stipulated with respect to the specific business processes necessary for the actual customer environment. An example to take into consideration: in SMARTEN the invoice furnishes account data relative to a user with regard to a specific contract. The invoice format, i.e. an invoice

to a company instead of an invoice to an end-user, can be defined at run time by way of suitable libraries. All the SMARTEN GUIs will be able to present the invoice data in the selected format without resorting to new code.

It is also possible to define at run-time specific attributes to be logged. The system will automatically keep the history of the values and any subsequent modifications. For example, the password of an important service.

4.2 Commercial Offering Definition Process

The definition of an effective planning process for a new commercial offering is a strategic point for Service Providers.

In order to uphold the definition of a complex commercial offering, it is necessary to have the following components:

- a) A Service Planning and Development process which allows one to define and rapidly develop new services or suggest improvements on existing services;
- b) A set of tools which allows one to modify existing services.

Concerning Service Planning and Development, the TMF suggests the process below.

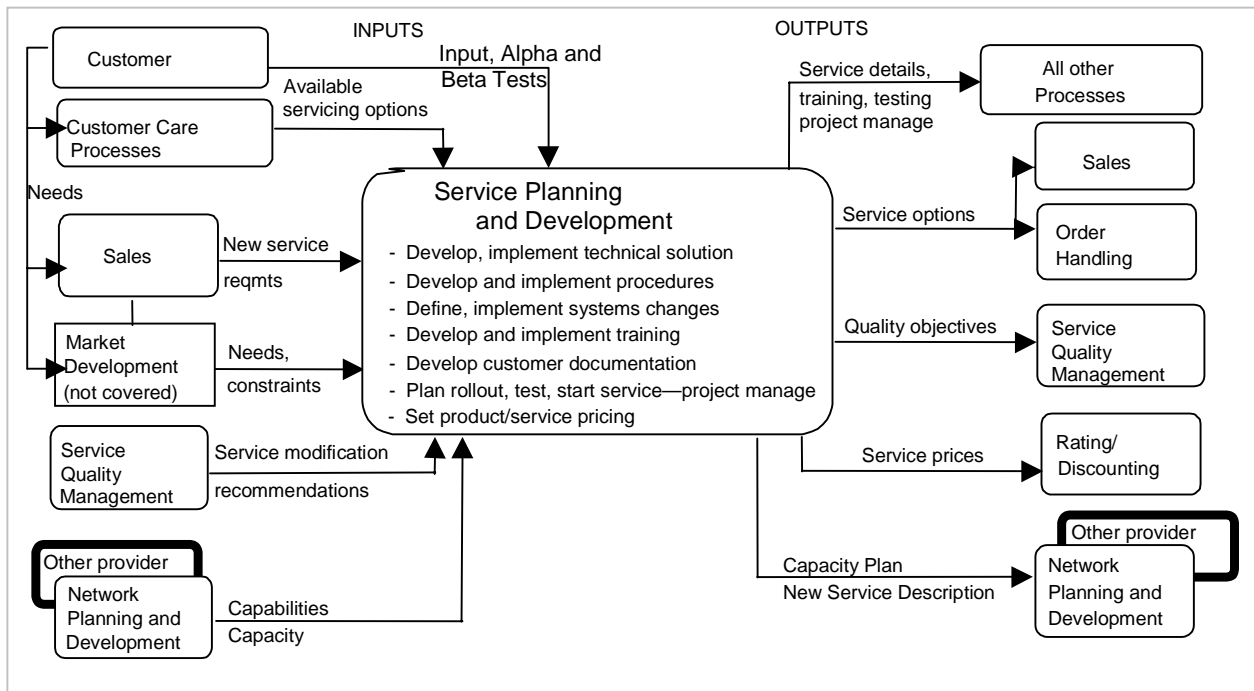


Figure 4-1; Service Planning and Development Process

To adhere to this process, SMARTEN not only provides a set of GUIs capable of rapidly modifying services, bundles and offerings but manages to achieve this goal without imposing any constraints on specific structures.

The definition process of a commercial offering can be organized as below:

1. Service Definition

A service can be defined as the answer to the question "What is being sold?".

Therefore, the service represents the minimum unit which can be sold. It is imperative to be able to define services both on a basic level (e-mail, internet access, messages) and on a more advanced level (VoIP, VPN) with related professional assistance (training, support, installation, etc...).

During this phase, one understands the fusion between market information, which requires commercial characteristics, and technical support, created by a platform and a provisioning system.

To meet such needs, SMARTEN labels each individual service with a specific name and relevant description which distinguishes itself from others. Furthermore, it also offers the possibility to add new attributes to each specific service. This function is fundamental to the provisioning process since it is closely linked to the service, i.e. name and dimension of a mail-box.

2. Bundle Definition

A bundle can be defined as the answer to the question “How will an offering be structured?”

Therefore, the bundle represents the minimum unit that can be registered in a contract.

A bundle is composed of various services previously introduced into the system and selected one by one by the operator during the composition phase of the bundle.

At the moment of adding a service name to the bundle, it is possible to specify if this service is optional or mandatory at contract stipulation. In this specific phase the operator must select the rating policy suitable for each service of the bundle. The rating policy consists in the selection of an algorithm which allows for the transformation of accounting data into money. Like in the service definition phase, the user can assign specific attributes to the specific bundle.

3. Commercial Offering Definition

A commercial offering is the meeting point for different marketing decisions. To adequately define an offering, it is necessary to answer the following questions;

- What is the target for this offering? For example, private consumer? Previous client? Chemical company? A conglomerate of companies?
- What is the price policy related to this offering? For example, are the first 100 hours of internet navigation free of charge? What is the price for a financial page? Discount proposals for each individual service?
- What is the billing policy? For example, monthly billing? Prepaid payments? Invoicing thresholds? Activation fees?
- Sales channel for promoting this offer? For example, internet kiosks? Our channel partner? Our internal sales office?

SMARTEN answers all of the above mentioned questions by utilizing specific GUIs and the bundles defined in the previous step.

4. Sales.

As soon as an offering is published in a price list, SMARTEN makes it available immediately on the GUI for selling contracts. Once a salesperson has the rights to utilize the GUI, consult the domain and the price list, he can then access the new offering in real time and draft the contract. Once the contract has been stipulated, the Customer Care Assurance process can take place immediately. By means of the metamodelling mechanism, the GUIs will adapt themselves to the new contract without codes or test phases to be enacted.

5 SMARTEN Components.

SMARTEN platform is built in a modular fashion which allows the carrier to select only the modules and applications it requires to meet its current business needs. An Enterprise Network Outsourcer will only need the Base System (the infrastructure and the basic objects), while an ISP will also necessitate the Accounting, Rating and Billing subsystems. More complex scenarios are suitable in the SMARTEN flexible proposal; a SP which owns a convergent billing system can retrieve rated CDRs directly from the Rating engine and does not need to purchase the Billing component of SMARTEN.

The following sections give a description of each main SMARTEN component.

SMARTEN components, shown in Figure 5-1, are the following:

- Base System;
- Customer Care, sub-divided in:
 - Sales Management;
 - Order Handling;
 - Problem Handling;
 - Self Care;
- Accounting;
- Rating;
- Billing.

However, the description can only give a subset of the possible features. A complete presentation of the characteristics is difficult to exemplify, due to the ability to create new ones by manipulating the core object model of the product. A full set of API, based on Java Beans and IDL can be used, without dealing directly with the complexity of object models and hierarchies.

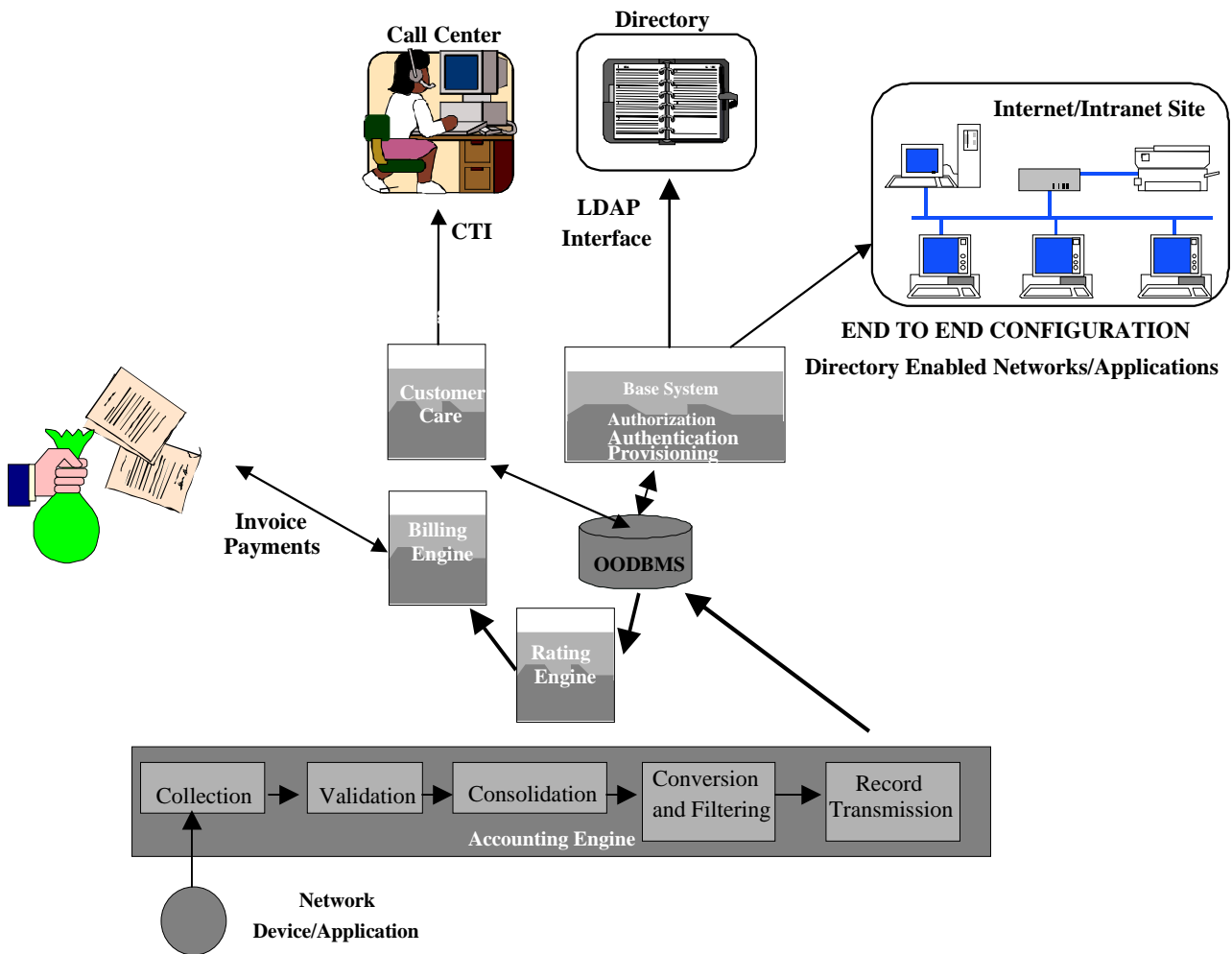


Figure 5-1: SMARTEN Functional Overview

5.1 Base System

The Base System represents the core of SMARTEN. This component is fundamental for SMARTEN deployment.

The SMARTEN Base System can be considered a 4-tier system with a completely Object Oriented architecture. Relevant to this architecture is its OO database (Versant, www.versant.com) which gives SMARTEN a significant advantage with respect to other competitors. Versant was selected for its high performance and pure OO architecture.

The four tiers of SMARTEN are illustrated below:

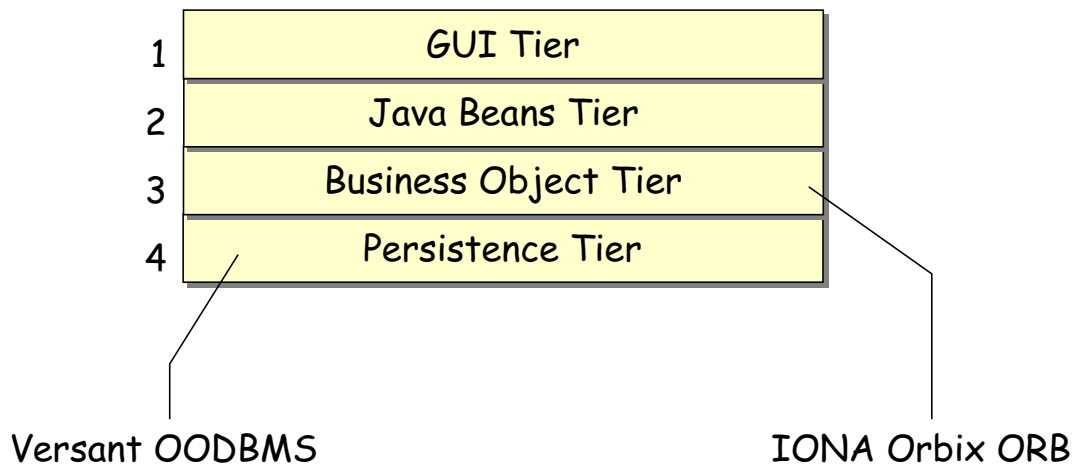


Figure 5-2: SMARTEN Software Architecture

Above the Persistence Tier, based on Versant, one finds the third tier, which hosts the application logic and rules with which the different Business Objects (services, contracts and clients) interact with one another.

The Business Object Tier, developed in C++, features a CORBA interface towards the second tier, developed by the Java Beans technology.

The first tier, composed by the GUI, is entirely developed in Java and in part based on applet and servlet technology.

The Base System component provides the following features:

- OO DMBS
- Service Definition
- Bundle definition
- Simple Price list management
- Security management
- Service provisioning

5.1.1 Service and Bundle Definition by means of Metamodelling

When a sales representative has reached an agreement with the client, a new order is submitted to the system. A CCR can now activate the process to actually deliver the service and can pursue the process status in order to give proactive information to the subscriber. A full Finite State Machine (FSM) has been implemented to map out changes a contract can sustain during its life.

The definition of a commercial offer is quite simple. Through SMARTEN, the Service Provider can define the list of services to sell. This can be achieved through a visual tool (Figure 5-3) that allows the attribute specifications composing the new service.

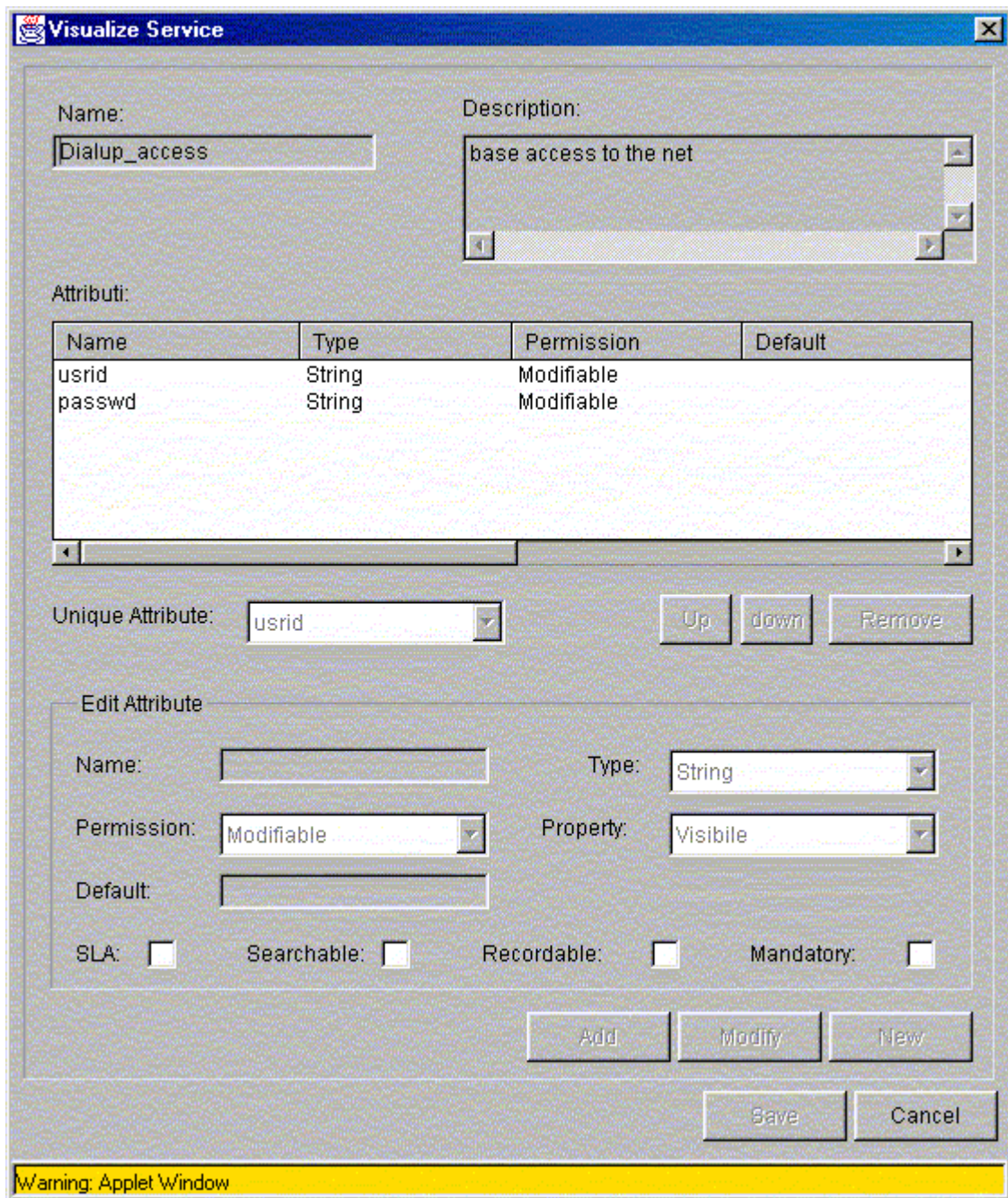


Figure 5-3: Service Creation

In the above example a Remote Access Service is represented. The features included are UserId, Password and the Guaranteed Bandwidth.

The second step consists in the building of a commercial offering containing the services previously defined. This can be achieved through the visual tools shown in Figure 5-4 and Figure 5-4.

In the first visual tool the Service Provider is able to specify the services sold in the bundle and the related rating and access policies.

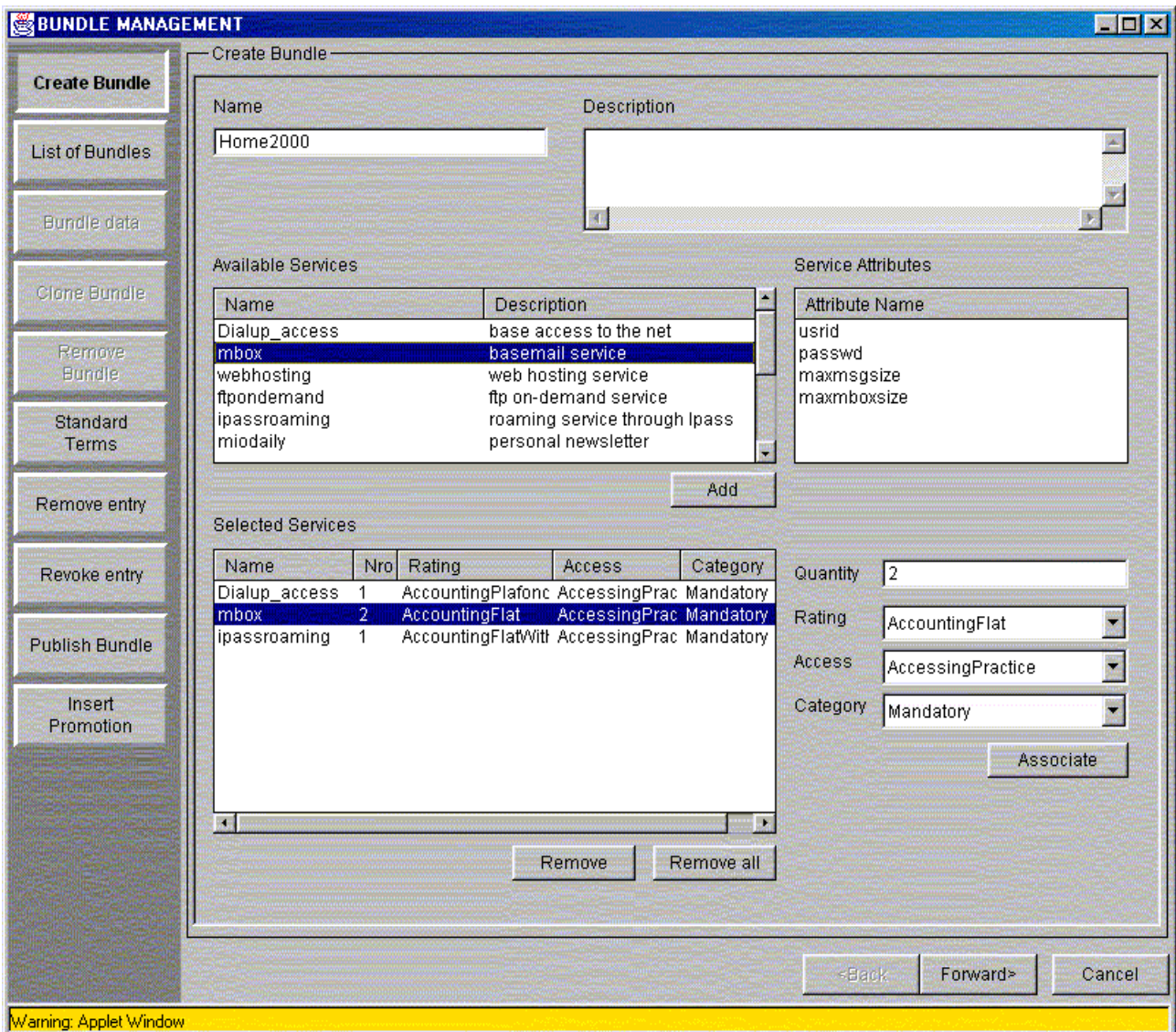


Figure 5-4: Bundle Definition 1/2

By means of the second visual tool, the Service Provider can publish the commercial offering by selecting a set of attributes for bundle identification, for example activation date, duration of the offering and salesperson identification.

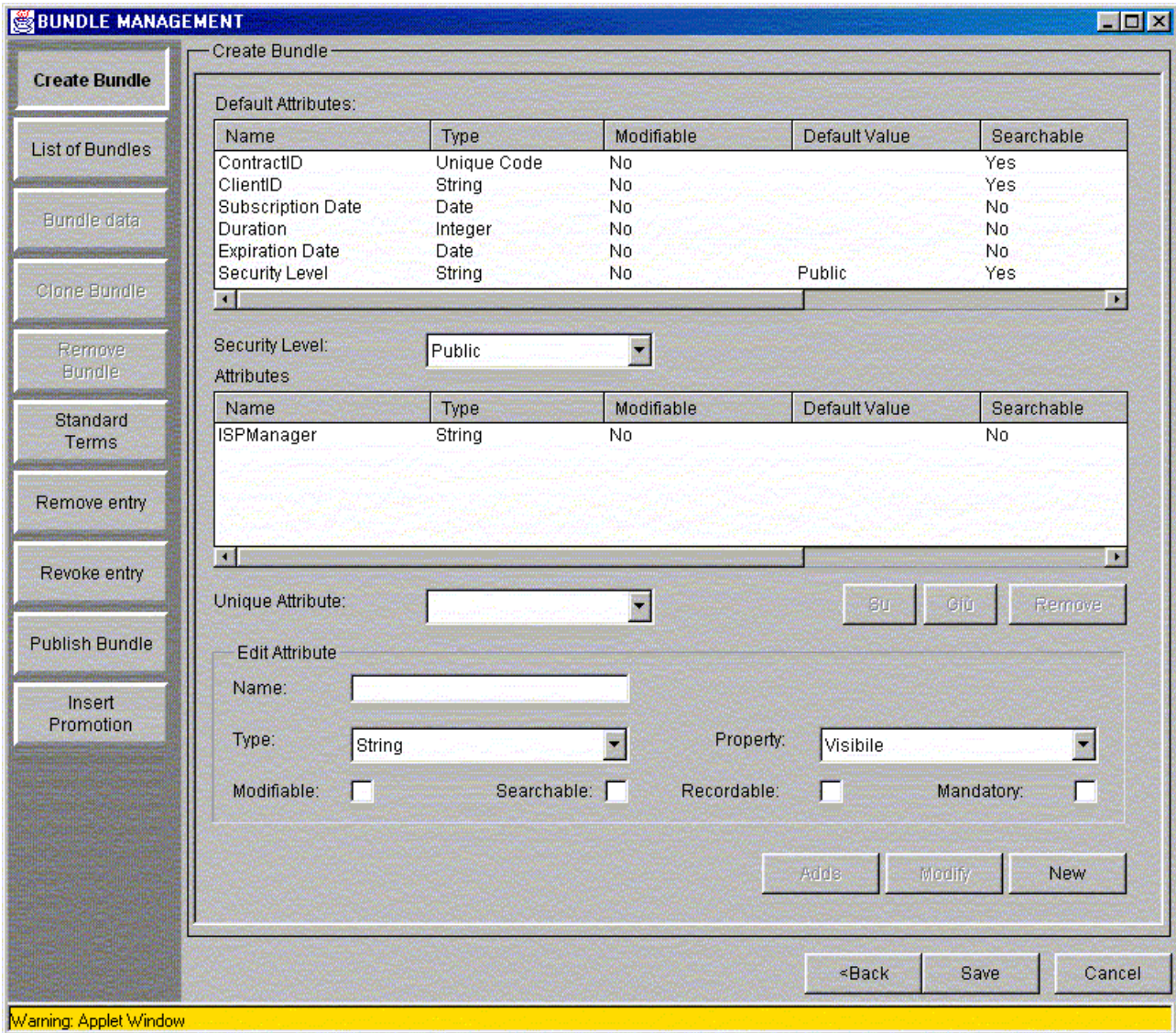


Figure 5-5: Bundle Definition 2/2

5.1.2 Security Management in SMARTEN

The complexity of the SP market scenario is highlighted by the fact that a large quantity of sensitive data is managed and exchanged by numerous individuals. In addition, great attention is paid to privacy issues and network usage and hence one understands the need for security in CCB systems.

In this light, SMARTEN offers quite a sophisticated approach to the security issue. Security schemes can be personally designed by SMARTEN users to fit the needs of their organizational and marketing divisions using a specific GUI.

SMARTEN security mechanism is based on three concepts:

- Profile
- Interface
- Domain

A **profile** is defined by a subset of functional characteristics unique to the native product. For instance, it is practicable for a generic Operative Marketing profile to be associated with the functional aspects of reading base services. Base service aggregation allows one to define bundles and the commercial offerings which will constitute the products to launch in the marketplace.

Definition of new profiles can be made by using a specific GUI which illustrates the native functional aspects which can be combined in the most opportune manner (Read Services, Define Services, Read Bundle, Define Bundle, etc...).

An **interface** is the means employed by the system to manipulate objects present in the database by interacting with SMARTEN Java Beans. This includes reading the same base services by different interfaces like Composing Services, Bundle Composition and Problem Management.

A **domain** represents a set of objects (contracts, customers, offerings) upon which lay potential access rights. One can state that a group of salespeople can only access information relative to contracts they have stipulated.

These three concepts find a meeting point in the definition of **group**. In SMARTEN a group constitutes a number of users who have similar profiles and can access through interfaces only specific objects in certain domains.

The figure below illustrates how the GUI defines a group.

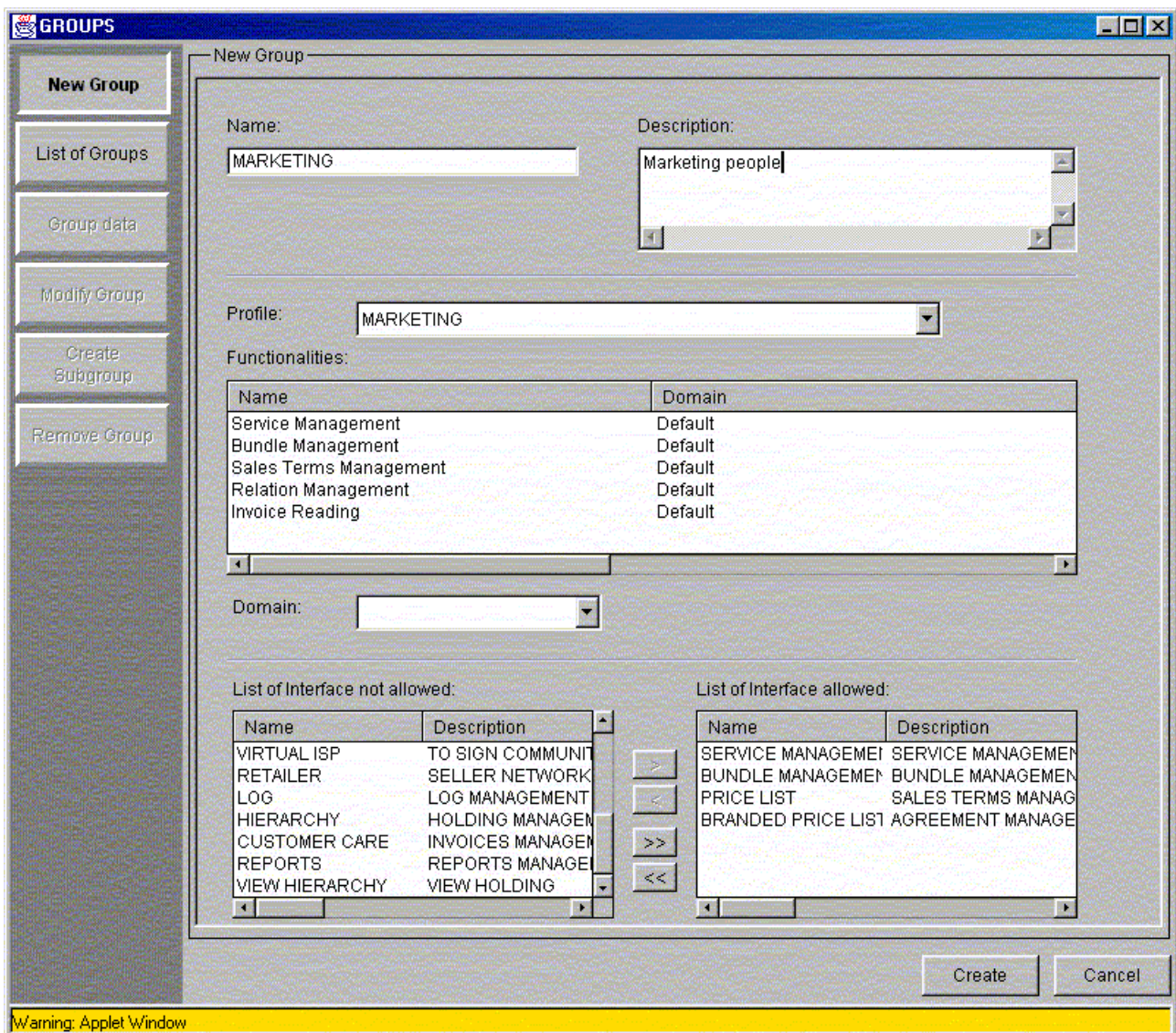


Figure 5-6: Handling Groups

If a user makes any attempt to execute illicit operations, he will be prevented by the following logical procedure:

1. The user must be in possession of an interface which permits him to attempt the prohibited operation.
2. If the user manages to overcome this obstacle he should have a profile which allows him to access the functional features requested for the operation.
3. Finally, he should have access to a domain in which the objects implied in the operation are present.

Obviously each SMARTEN user is furnished with a User-Id and a Password – the system is open to integration with electronic certification- and any modification to the database is logged and made available through a specific GUI.

5.1.3 Modelling Complex Organizations

A feature offered by SMARTEN security management is the potential to model complex and structured organizations by way of the **subgroup** concept. The subgroup represents a set of users characterized by a profile and access domain which is confined by the definition of the main group which subsequently created the subgroup. The following diagram depicting a tree-structure can adequately demonstrate the subgroup theory.

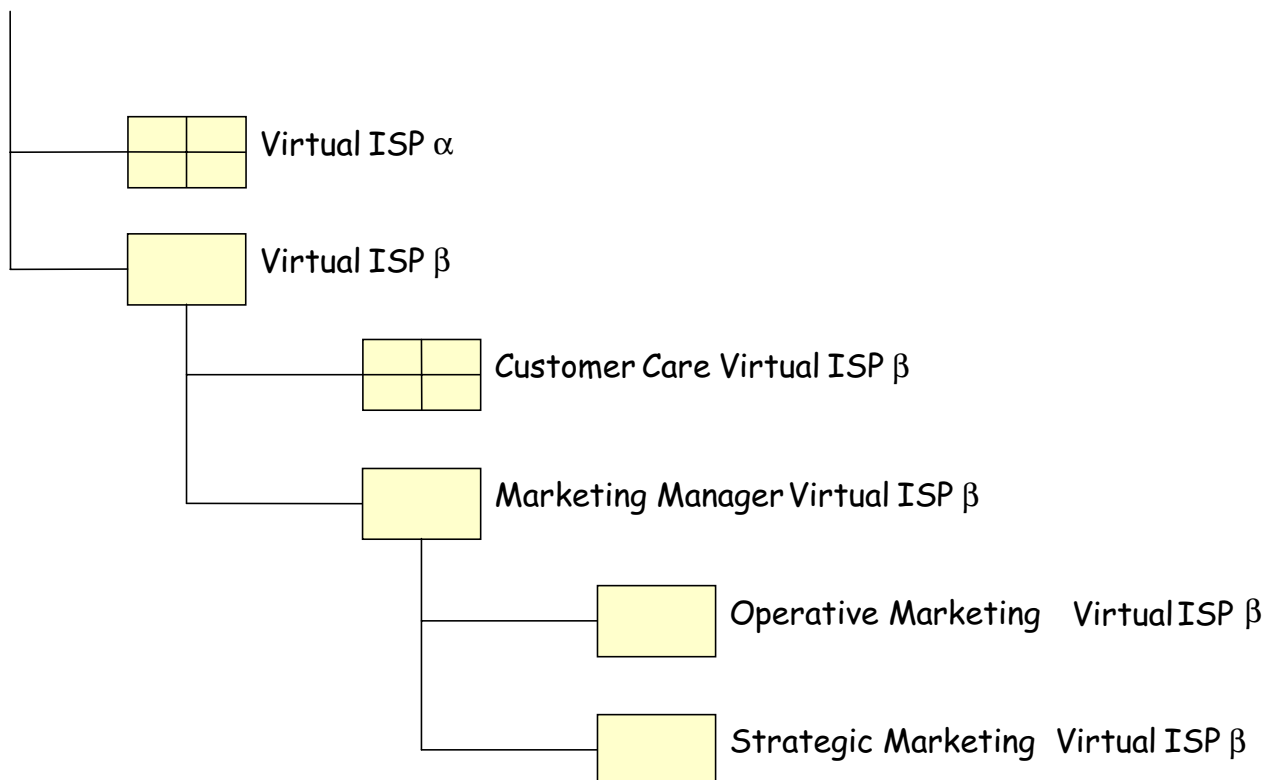


Figure 5-7: An Example of Organization Modelling in SMARTEN

In the above example, the Marketing Manager group has profiles and interfaces which allow it to access all relevant information to marketing in the domain of objects in the Virtual VISP β. The

subgroup Operative Marketing, on the other hand, can only access interfaces related to bundle and price-list management whereas Strategic Marketing can obtain information related to reporting and customer company organization.

5.1.4 Service Provisioning in SMARTEN

5.1.4.1 The Event Handler

SMARTEN boasts the capability to generate events related to modifications in the Persistence Tier.

Using a configuration file it is possible to communicate to the system which operations are necessary (create, update, delete) in order to create an event.

Such events are intercepted by the Event Handler module which has the task of distributing them to specialized agents and that, in turn, take charge of their handling.

In the event of a failure in dispatching towards the agents, the Event Handler is capable of recovering the situation since SMARTEN saves all events until complete delivery has been confirmed. This facilitates the customization of tasks to be carried out in the event of an error during a provisioning operation. For example, one can either automatically send an e-mail giving an error notification or raise the issue to a Trouble Ticketing system.

SMARTEN is quite unique in this phase since any event notification must be activated in SMARTEN which prevents computer resource consumption in case of futile events.

5.1.4.2 A Provisioning Agent

A provisioning agent can be divided into three distinct parts: the interface towards the Event Handler, the interface towards the external system and the conversion module.

In the first part, all the agents are the same since the IDL provided by the Event Handler is independent from the event type that the agent will manage.

The interface towards the external system can change both with respect to the provisioning features requested (provisioning a mail-box instead of activation of a User ID on a NAS) and to the specific platform (activation of a mailbox on an Isocor Mail Server is quite different from an activation on a SIMS platform).

The goal of the conversion module is to aid the adaptation of the two interfaces, the first being standard and stable, the second being strongly dependent on the external system.

The following diagram illustrates the concept.

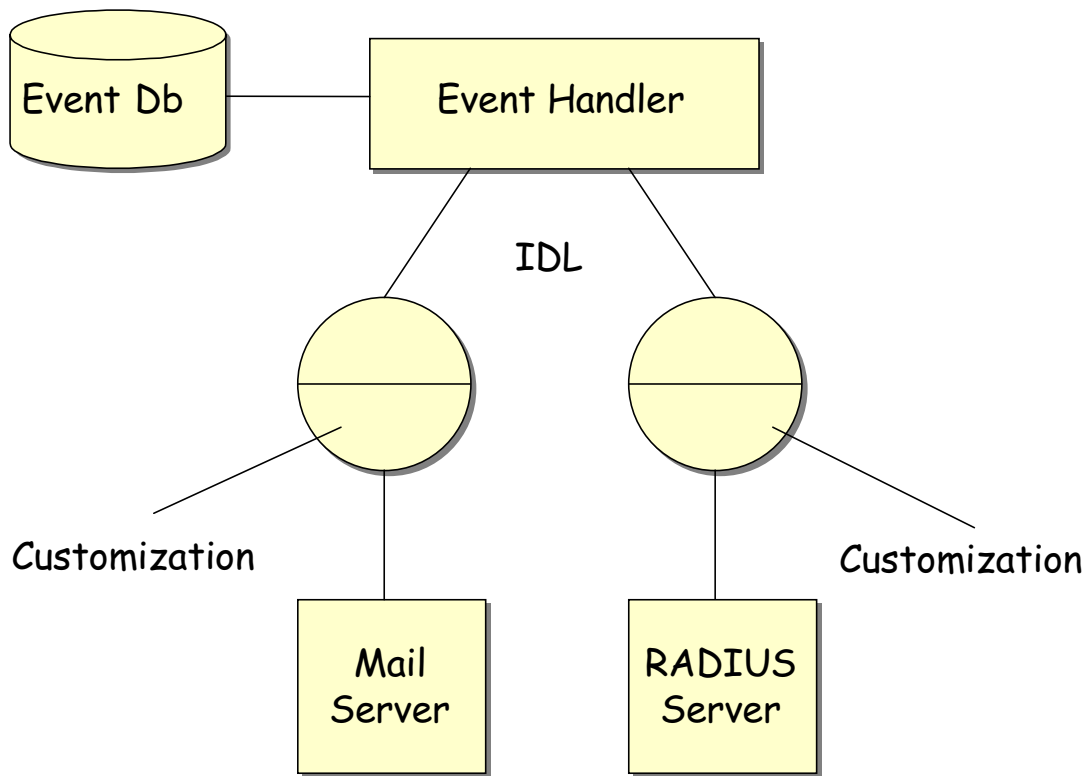


Figure 5-8: Provisioning Architecture. An Example

5.1.5 Interfacing External Storage Systems

In case the user needs to align data present in the SMARTEN database with that in another storage system, the same mechanism based on the Event Handler can be used.

For example, this kind of situation occurs when an operator already has a Customer Care System and needs to be updated with new data recorded by SMARTEN.

Another case is suggested by a marketing office which needs an off-line database in which to carry out complex data mining operations. In this situation the customization of the product must foresee SMARTEN data aggregation into tables of a related database. The event handling mechanism will notify the proper agent of the requested information maintaining the consistency of the data in the two storages.

5.2 Customer Care

The SMARTEN Customer Care component provides many features for supporting:

- Sales Management: functions to support the operation of sales representatives.
- Order Handling: functions to handle each step from contract definition to service delivery.
- Problem Handling: functions to register customer inquiries.
- Customer Self-Care.

5.2.1 Sales Management

SMARTEN can be customized to fit any specific company sales policy. During system set-up and at runtime, one can define sales organization, both internally and externally (channel partners). Each sales representative will have a personal profile defining his ability to operate on a domain of customers, services, price lists, promotions and conventions.

Once a sales representative is granted access to the system he can freely operate on services, bundling of services and price lists in order to prepare personalized offerings to customers. He is also free to offer variable discounts or apply special payment terms, in addition to storing information within the system with respect to prospects and offerings, which can eventually be updated at contract subscription.

The same features, or a group of them, can be used by external sales individuals of channel partners. Due to the light client architecture, neither software distribution nor change management is required to keep the users, working on Extranet, running the same release of software.

5.2.2 Order Handling

The Order Handling module is the component of SMARTEN which allows salespeople to sell contracts related to commercial offerings already published in SMARTEN price lists.

The typical steps provided by this module are:

- Filtering and selection of the offering based on the salesperson's domain (clients and products).
- Granting possibility to carry out commercial negotiations on the basis of a flexible offering with pertaining values (e.g. discounts).
- Registering customers as service user and the actual payer of the invoice.
- Placing the contract in an ordered status (awaiting actual activation).

5.2.3 Problem Handling

The Problem Handling processes are modelled in SMARTEN as above. A Trouble Ticket template is available to CCR to register complaints from customers. The ticket, if not immediately closed, is then passed on for escalation to a specific product (ARS Remedy). ARS Remedy handles all the required steps, with notification to SMARTEN of each step by way of a specific interface. In this manner, the CCR maintains visibility on the ticket status and one can interact proactively or reactively with respect to information given to an unsatisfied customer. States and transitions (reasons for transitions) are handled and stored by SMARTEN through a specific FSM.

5.2.4 Self-Care and Customer Contact Point.

Due to the SMARTEN web based user interface, the Customer Care component also provides self-care features which permit the customer to self register for new services, send service orders and notify problems. In addition to Internet, other ways to interact with Customer Care operators (Customer Contact Point) are:

- Telephone line (through PBX integration)
- Fax: incoming and outgoing
- Postal: for delivery of paper documents

SMARTEN offers an integration to all the above systems which organizes the related tools directly on the operator workstation. Each tool has a Java based client that can be run from the browser through the Net, Intranets and Extranets.

In the case of the telephone line interface, the integration is possible due to the use of the standard JTAPI interface and is compatible with PBX providing an TAPI or TSAPI interface.

This architectural characteristic provides all the distribution and flexibility of a Web based approach, avoiding the inefficiency of the connection-less and state-less http protocol because it uses the connection-oriented CORBA standard IIOP protocol between the client and the server.

Self-Care features are:

- add, modify or delete services in his contract
 - update address and mailing information
 - view aggregate or detailed usage data
 - view billing data and contract status.
-

The following Figure 5-9 gives an example of a self-care web page where the end-user can access data related to contract information



Attribute Name	Attribute Value
Duration	12
Fixed Fee	850000.0 Lire
Fee Rate Number	1
Activation Fee	50000 Lire
Activation Fee Rate Number	1
Max Threshold	300000 Lire
Max Threshold	200000 Lire
Invoice Discount	0

n.	Service	State
1	Dialup_access	Active
2	mbox	Active
3	webhosting	Active
4	ipassroaming	Active

Figure 5-9: Contract Self Care

The following figure is an another example of a self-care web page where the end-user can access data related to billing data.

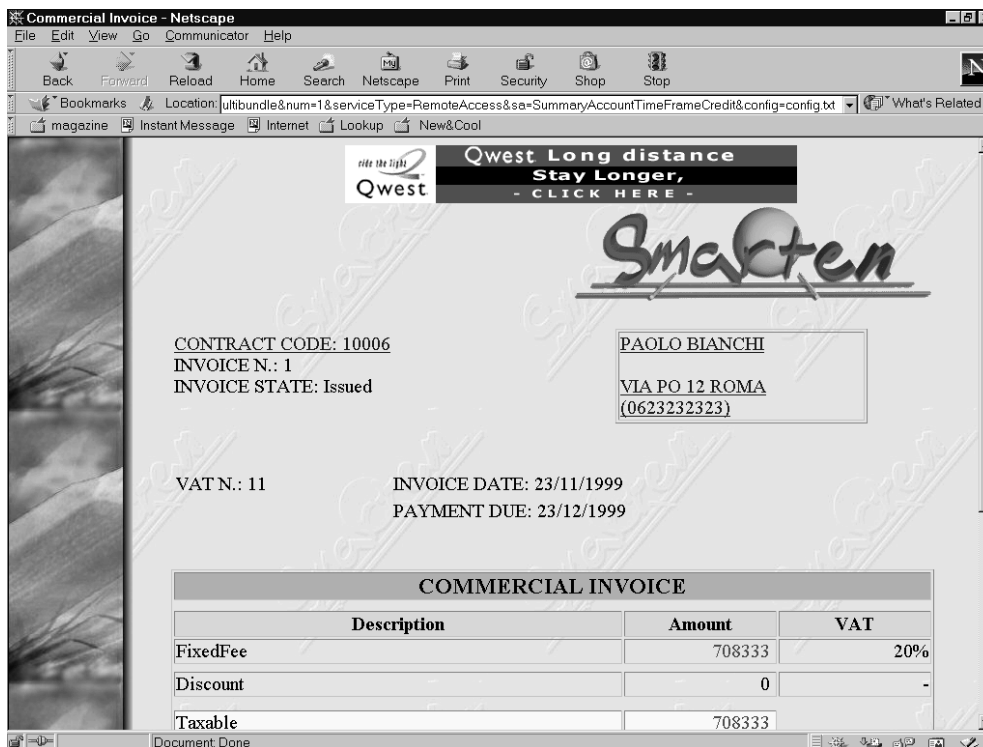


Figure 5-10: Billing Self Care

5.3 Accounting

The SMARTEN Accounting subsystem was designed according to the technological and functional requirements typical of a carrier grade system. From the technological point of view, it is based on a distributed approach which guarantees scalability and fault resiliency. The single modules of the subsystem are implemented using Java and C++ languages and use CORBA architecture for data transmission to the SMARTEN Rating Engine.

From the functional point of view, the subsystem is capable of executing typical processing operations on information originating from the network, from the applications for billing purposes or from the off-line data mining services (e.g. customer behavior analysis).

Processing operations are:

- **Collection:** responsible for data collection from network equipment and application;
- **Validation:** guarantees data integrity. Collected data is processed to verify the presence of defects such as absence or duplication of data and to oversee out-of-order data records;

- **Consolidation:** executes data aggregation, if necessary, optimizes data volume for delivery to the next processing stages;
- **Conversion and filtering:** responsible for format conversion into a single standard format. It also provides filters to remove inconsistent or insignificant information for system purposes;
- **Record transmission:** responsible for safe data transmission. Recovery and re-synchronization functions are foreseen in case of data link failure among components of the Accounting subsystem.

The architecture of the Accounting subsystem is composed of a set of distributed elements which co-operate in order to guarantee the features mentioned above.

The figure below shows those components and provides the flow of data.

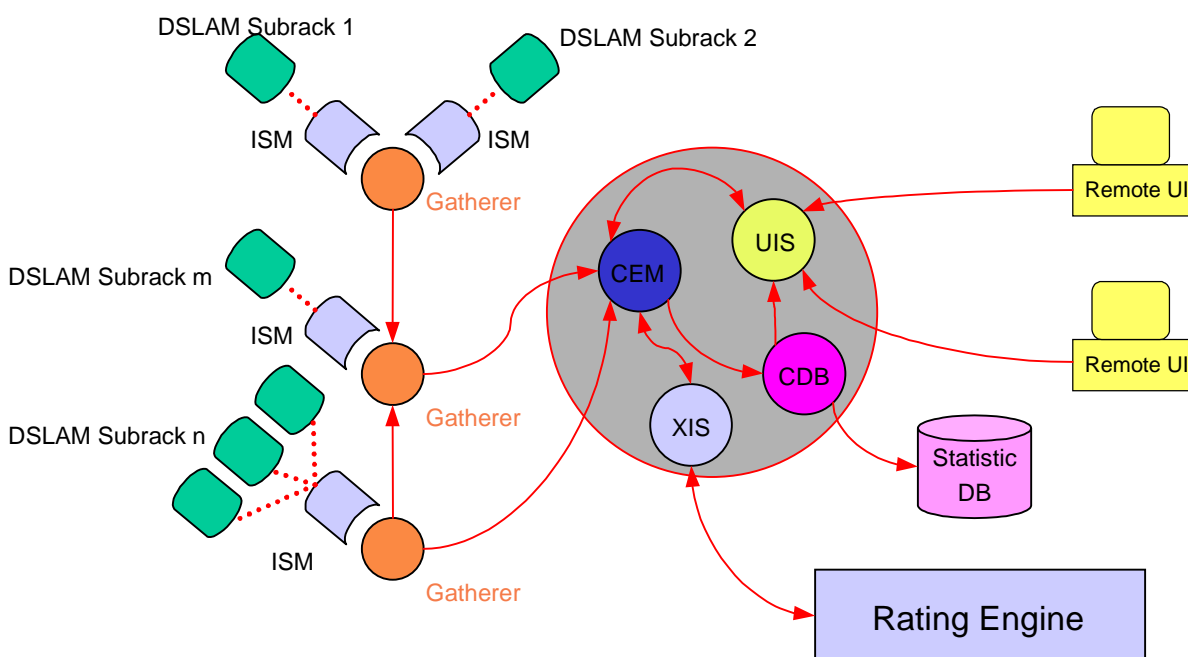


Figure 5-11: Accounting subsystem architecture

In the figure the following elements are defined:

- **Information Source (IS):** network elements which produce information on network and service usage. In this case, these constitute DSLAM subracks providing raw data with regard to the ADSL connection usage. These components are external to SMARTEN architecture.
- **Information Source Module (ISM):** software components which collect data from the IS.
- **Gatherer:** software components which execute processing on records received from ISMs.
- **Central Event Manager (CEM):** supervisor process which also provides data brokering functions for data consumer components.
- **User Interface Server (UIS):** component which delivers relative information towards the operator workstation.
- **Extended Information Server (XIS):** event-driven CORBA interface which transmits data towards other real-time subsystems like the Rating Engine.
- **Central Database Manager (CDB):** component which provides data storage in an Oracle database in order to support statistical analysis and off-line reporting.

5.3.1 Information Source

Some applications and network equipment provide information on network traffic. By accessing these IS, SMARTEN can collect the data necessary to carry out a detailed billing of services provided by the network and by considering actual employment by the end-user.

The IS managed by SMARTEN can be defined in various categories.(network equipment, applications, monitoring equipment, access and directory applications).

In this case, the main IS for the accounting subsystem is represented by the DSLAM Subracks and, in particular, by the respective MIB to interface.

By using specific ISMs, or a combination of them, the requested flexibility can be achieved in order to obtain a CDR (Call Data Record) database. This database can be used for real-time billing or for data mining applications.

5.3.2 Information Source Modules

SMARTEN ISMs are intelligent and light-weight software agents, designed to operate as background processes on undedicated platforms. ISMs can collect data on network sessions produced by a variety of different information sources. In this case, there is a single type of ISM which interfaces with DSLAM MIB to obtain data concerning the number of cells passed up-stream and down-stream.

ISMs should be installed as close as possible to the information source to minimize network loading. ISMs can send the data they collect either to other ISM, for record enhancement, or to the Central Event Manager, for storage in the SMARTEN repository, and to be subsequently processed on-line by the Rating Engine. Each ISM can collect information from more than one IS, to allow the organization of fully scalable hierarchies of the data collecting system. ISMs use specific interfaces with IS which do not interfere with normal IS or other ISMs operations.

ISMs use a remotely configurable local cache memory to store incoming data from ISs. This characteristic allows the administration of link faults without data loss and permits a synchronized reset function. ISMs are remotely managed by the Central Event Manager for both configuration and upgrade.

5.3.3 Central Event Manager

The CEM manages the collecting, processing and recording mechanisms of the Accounting SMARTEN subsystem. Data collected and processed by the ISMs are stored by CEM in an external database. The CEM's duty is to consolidate information coming from multiple sources by eliminating possible data duplication. This situation can take place when a session is set up between a node in a WAN and another node; such a session could be recorded twice from the respective ISM of each node. Once the information is stored in the database, data is available until CEM declares it no longer valid. This occurs if limits on expiration time or maximum volume were set up on specific data.

The CEM allows configuration and administration of the entire ISM and IS system; and continuously monitors their status. The administrator has the capacity to monitor a specific source, and to display the current status and activity log.

The system update can be executed in a single shot at CEM level, and in fact, ISMs automatically update their software once it is defined and registered in the subsystem.

CEM is accessible through a Java-enabled Web browser. The subsystem configuration is protected by means of a password, allowing only authorized users to access and modify the subsystem and read personal accounting data. The system is configured by means of a series of wizards which aid the user during installation and configuration procedures. On-line help is always available to provide additional support.

The CEM needs a suitable computer equipped with sufficient memory, CPU and networking capacity for each specific system.

5.3.4 The Enhancement Process

Data collected from asynchronous sources (i.e. the DSLAM subrack) must be enhanced by correlating it with other information sources. This is necessary in order to record accurate accounting data in the subsystem database. The administrator can select which field of the collected records to use as input for other sources to get new enhanced records. The enhancement process can be repeated until all data necessary for accounting is available and stored in the database.

The subsystem can choose the most convenient path in case of multiple enhancement flows and when optimization is possible.

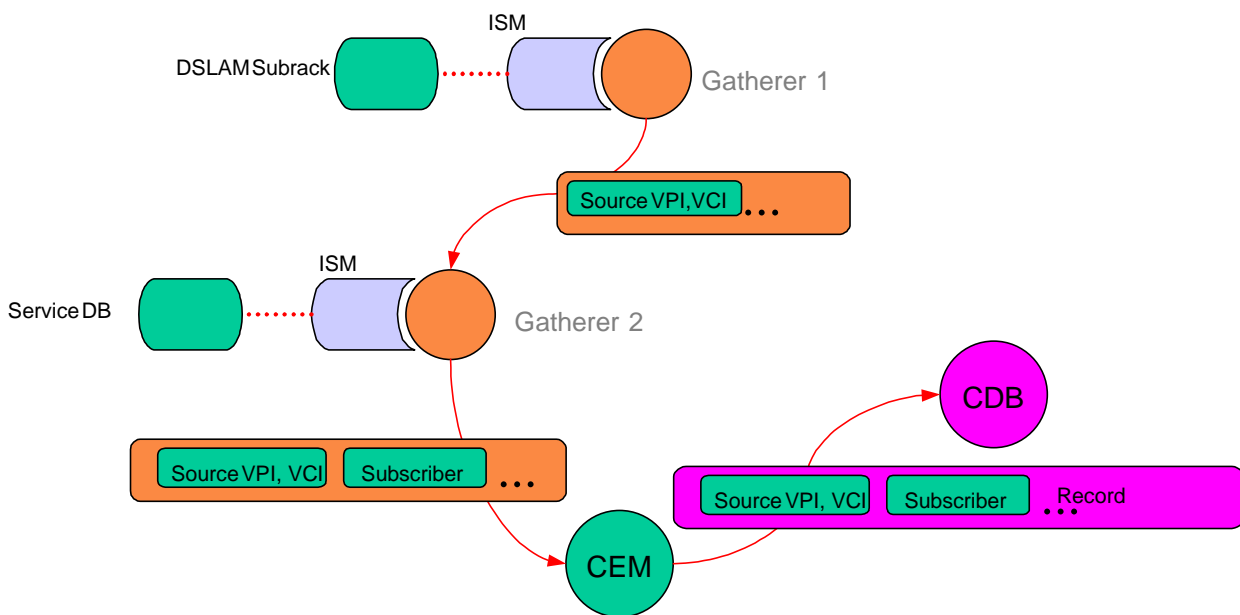


Figure 5-12: Accounting Enhancement Process

5.3.5 Statistics and Reporting

Since SMARTEN is an OSS that executes critical on-line operations (authorization, real-time rating etc.) it does not allow the use of its internal Object Oriented database for “data mining” activities. However, such data is essential for marketing and sales groups to understand user behavior, quality of service delivered, etc. To provide such functions without jeopardizing system performances, SMARTEN can be coupled with an Oracle database which receives all information from the ISMs. A Visual Reporting Tool (VRT) is also available to manage reporting and statistic requests. Users of this subsystem can access VRT by means of a Java-enabled Web browser.

VRT can assist the user in the definition and customization of Accounting and Billing reports on the basis of data stored in the database. The system is provided with a series of predefined inquiries and reports, which can meet the most typical requests. Furthermore, there is the possibility to design new reporting layouts and / or modify predefined ones. These tools are also supplied with a series of graphic functions which allow the automatic display of report results in diagram formats (charts, bars, pies, etc.)

Reports can be produced on-line, directly from the browser, or as batch jobs. This feature is quite useful when in case of periodic production of reports is necessary - daily, weekly, monthly. Various output formats are supported

- HTML or “delimited text files” – which are needed for most office and business operations.

These inquiry and report functions facilitate data mining and give way to the possibility to quickly access real world session entities. These features can be used to obtain reports which can help in the validation of different business models.

In fact, different scenarios relative to different billing policies can be simulated on predefined periods. This reduces the risks of introducing new billing schemes.

Data format in the Oracle database is available to third-party reporting tools.

5.4 Rating

The SMARTEN rating system is based on a rating engine capable of interpreting rules. Rules are defined by the rating policies. Such an approach allows the management of rating policies in a dynamic library format. This system can access the library in order to implement the rating selected in the commercial offering. If new policy ratings are necessary, it is sufficient to code the specific C++ (easily obtainable at a low cost and in an *elapsed time* mode) and relay the new functions to the SMARTEN library.

SMARTEN’s high performance is achieved through its OODBMS which allows effective on-line rating without overloading the processors and therefore minimizing hardware resource costs. The system also supports less complex rating policies like batch or on-demand.

Data produced by the rating engine can be easily exported in diverse ways (text files, 3270, etc...) towards external billing systems.

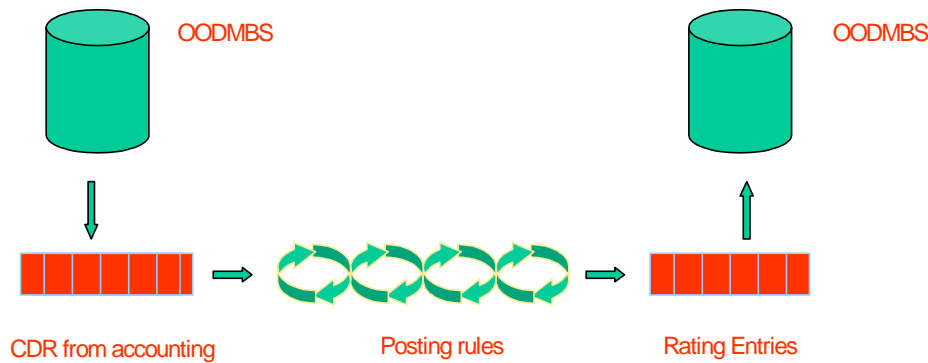


Figure 5-13: Rating Engine

5.5 Billing

Like the accounting component, the billing subsystem is based on an engine capable of complete comprehension of the billing rules.

In addition to the advantages stated for the rating component, the distinct approach and the architecture of the system allow SMARTEN to provide a highly advanced Billing Presentment. Furthermore, in addition to invoice presentation, the system grants the user the following self-care utilities:

- Navigation into personal and contract data
- Access into personal accounting data
- Billing on-demand of personal accounting data
- Request to send invoice via e-mail to a dynamically defined address

The on-line rating mechanism allows real-time presentation of monetary charges.

SMARTEN obviously supports multi-currency, different billing cycles (daily, monthly, etc...), invoice customization and concedes a different billing addressee than the actual contract owner. This aspect is useful to companies which offer benefits to their employees. Another feature of the

SMARTEN billing subsystem is the possibility to define billing thresholds; upon reaching these maximum and minimum thresholds, special payment terms can be applied.

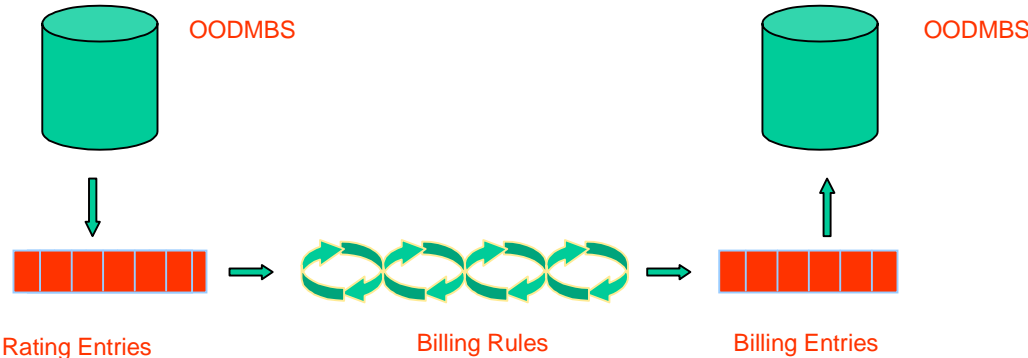


Figure 5-14: Billing Engine

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