SWWS – Semantic Web Enabled Web Services

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Summary / Contents:

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This Case Study focuses on the dynamic configuration of a system that generates notifications and suggestions for transactions to the customer related to conciliation between financial accounts and pending invoices. Due to low reliability of SMS and email notification services this Case Study introduces requirements for a flexible framework for service compensation.

SWWS Consortium

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List of Acronyms and Abbreviations

ISOCO	Intelligent Software Components S.A.
CGC	Consumer Goods Companies
WSMF	Web Service Modeling Framework
WSMO	Web Service Modeling Ontology
CNA	Customer Notification Agent
SWRL	Semantic Web Rule Language
SMS	Short Message Service

1 Introduction

The purpose of this document is to describe the Services and Ontologies used in the building and description of a Notification Agent. Notification Agent aims to prevent the user of financial services from getting into overdrafts on his bank accounts.

This Case Study uses an aggregation system implemented using Web Services, developed by iSOCO, called GETsee. ISOCO GETsee® is a solution for intelligent aggregation. ISOCO GETsee® application is able to aggregate information coming from different sources. It can be financial information (saving accounts, credit cards, investment funds, etc.), different invoices from consumer goods companies, loyalty cards, insurance companies or e-mail accounts from different Web Portals.

Once a costumer of GETsee® has all the information of his Banking accounts and the information of different CGC (Consumer Goods Companies) in the same place, it would be an added value for the system if it could detect, inform and sort out when some kind of financial overdraft is going to happen in an account.

This Case Study involves a large number of web-service operations (including existing GETsee® Web Services and other new Web Services built for the Notification Agent) that will be coordinated in the context of a WSMF / WSMO[1] (Web Service Modelling Framework – Web Service Modelling Ontology) .

This Case Study focuses on the dynamic configuration of a system that generates notifications and suggestions for transactions to the customer related to conciliation between financial accounts and pending invoices. Due to low reliability of SMS and email notification services this Case Study introduces requirements for a flexible framework for service compensation. The dynamic service configuration should successfully deal with service failures in run time and take compensation action in order to achieve the overall objective.

2 Scenario description

2.1 Business Description

The idea of the Notification Agent is to provide added value to the user including a fully customizable and configurable set of aggregations and estimation functionalities on balance evolution as well as SMS and email alerts, allowing the customer to have more efficient information about his financial position in the incoming time period.

iSOCO GETsee® aggregates information from a variety of sources including Financial Services (current and savings accounts, credit cards, securities, investment funds, etc.), invoices and contract data from Telco's, Utilities, E-mail accounts, etc. With iSOCO GETsee® customers can transfer money between accounts, contract financial products, pay bills, buy electronically or auto register to other on-line services.

Several estimation functionalities will allow calculating balance evolution on different accounts according to expected invoices and payments. The foreseen value of account balances will allow firing alert rules defined by the user and managed by the Notification Agent application.

Those alerts could let him anticipate any trouble which could happen in his accounts or avoid missing any business opportunity. Some configurable alerts could be:

- The balance of some account goes down under a specific amount of money (not necessarily zero)
- Some loyalty card goes up over some specific amount of points.
- Arrives a transaction to some account where some condition is present (concept, revenue higher than, issuing company).

As part of the configuration the customer will indicate to the system how frequently the system has to check the different conditions.

In our Case Study we will focus on part of the problem. We will try to detect (every day) if any of the customer accounts is going to be in an overdrawn situation. An account can have invoices from different CGC. But the Consume Date of the invoice could be too late for an account with a small amount of money (it could be the same if the amount of the invoice is quite large). For helping the customer, the system will calculate an estimation of the amount of every invoice expected for that account before its Consume Date and will notify the customer if the balance of the saving account is lesser than the expected invoice amount. The system will choose some notification channel available and will notify the user about the overdraw possibility.

2.2 Agents and actors involved

Integration of applications is one of the most ambitious goals of the Semantic Web Services. The existence of different agents or legacy applications must not interfere in the shared use of information. Exploiting the advantages of semantic interoperability and loose-coupled services will allow us to interconnect different applications and integrate data and information through messages.

The system to be built leans upon an existing iSOCO's commercial application and others agents or services built *ad hoc*.

2.2.1 GETsee®

By aggregation we mean the process of collecting and putting together data from different sources so that they appear to the client as if they come from a single data source.

In the context of the web, the different data sources are different online sites that serve HTML pages. The process of parsing the HTML pages and extracting the relevant data is called „screen scrapping". The aggregator simulates the process that a user of the online site would follow to access the data using a browser: login, make selections, push buttons and follow certain links, perhaps conditionally depending on the data actually shown by the browser. For instance, most online banks show all the accounts the user has available once the user has logged into the service. The aggregator must be able to recognize the account numbers and follow those links to gather all the relevant information.

Basic aggregation enables users to have simultaneous access to all relevant online services and information through a single interface.

The aggregation of customer data permits its exploitation by intelligent agents, turning basic aggregation services from being just an online gateway into a smart advisor: "Is my portfolio optimized for my risk profile and life style? Could I reduce my phone bill by switching to another operator? Could I save money if I split my shopping cart between different online stores? Can you find me product x for price y? No? Notify me when you do. Can you send me an SMS when there's no credit for my next invoice? Can you tell me when can I expect to earn enough frequent flyer miles for that trip to the Bahamas? Can you remind me when it happens?"

In Figure 1 Conceptual Architecture of GETsee, we define the conceptual architecture of GETsee.

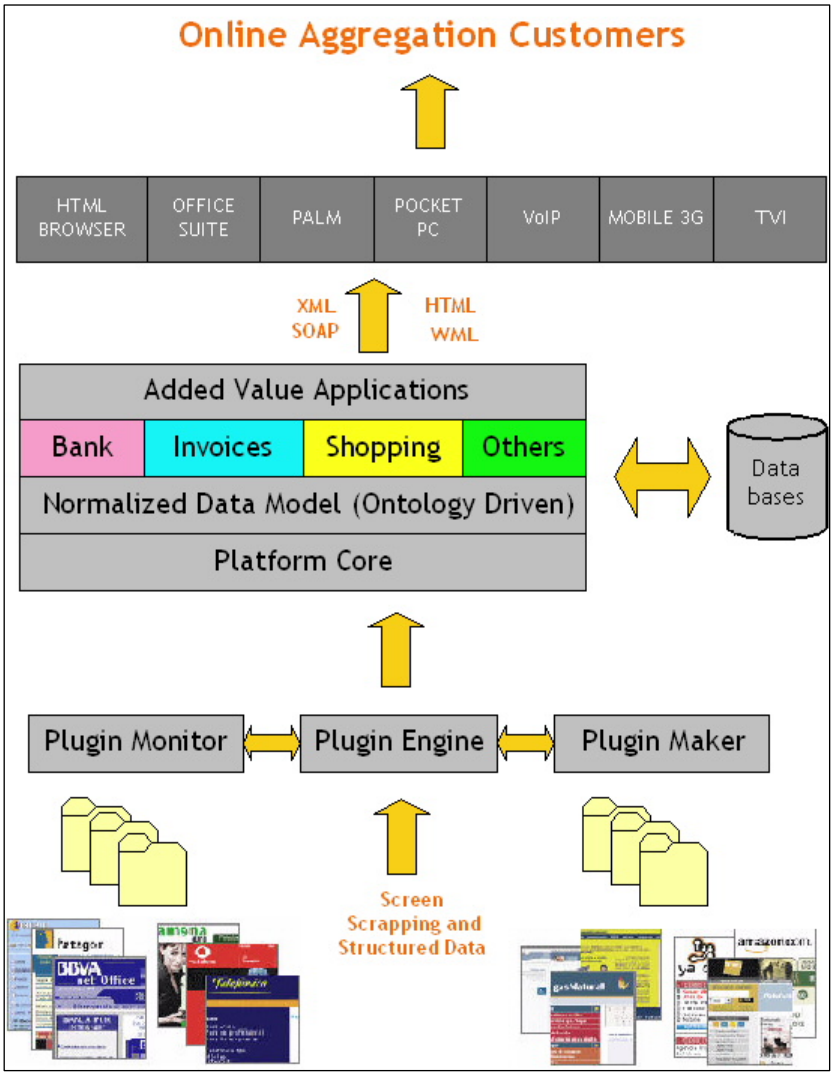


Figure 1 Conceptual Architecture of GETsee

For each online site that is to be aggregated, there is a plug-in that encapsulates the knowledge about the online site:

- How to log into the service
- What links to follow
- Where the relevant data are

The plug-in engine is responsible for executing the plug-ins, which are expressed in an internal wrapping ontology, and returning the data extracted by the plug-in. The aggregator itself gets the data from the plug-in engine and stores the data in a local database that serves as a cache. As updating the data from the different sites is a lengthy process (in the order of a minute), the information that is shown by the aggregator to the clients is that of the last update, which was saved to the database. Currently, updating of the data in the local

cache is only done under the user's request, although other policies could be established, such as updating the data in batch mode in a nightly process. The internal database also stores other data, such as user registration data, on which entities the user has accounts, and the logins and passwords on each of the sites to be aggregated.

Trying to improve this approach, we have defined a Semantic Web Service Interface to GETsee, building a domain ontology (ProductDescriptions Ontology) and constructing several Semantic Web Services that could execute tasks behind the plug-in.

2.2.2 Customer Notification Agent

The Customer Notification Agent (CNA) is a piece of software programmed by (or for) the final customer. Each day (or whatever other frequency) look for a Semantic Web Service able to access customer banking accounts, access different consumer goods companies accounts, access invoices, make some spent estimation in terms of rules (or heuristics) and notify the user if some threshold is reached.

2.2.3 Estimation Services

Estimation services (ES) are in charge of calculation the time evolution of account balances according to their foreseen incomes and expenditures. We are considering different statistical approaches for the final balance estimation allowing the Notification Agent checking and firing user notification rules.

2.2.4 Sentinel

Sentinel implements the composed service as the result of dynamic configuration of available services for information gathering, balance estimation and user notification. It constitutes the basic functionality of the Notification Agent.

2.2.5 The bank

The bank is the provider of the information in the specific case of saving accounts. It could provide the information in terms of online web sites (taken by screen scrapping techniques) or by means of Web Services (it is not usual, but we could make this assumption for the sake of the Case Study).

2.2.6 The Consumer Goods Company

This company has some contract with the costumer and invoices some amount of money to the bank account each predefined period. Many of them have online access to the current

expending in this very moment (this could be useful in some consumer goods companies whose product has a continuous spent like gas, electricity, phone consume, water or others).

2.2.7 The customer

The customer is the final user that makes use of the Notification Agent functionalities.

3 Ontologies

The word ontology is taken from Philosophy, where it means a systematic explanation of being. Whereas during the 1990s, this word became relevant for the Knowledge Engineering community. [Guarino and Giaretta, 1995][3] propose to use the words 'Ontology' (with capital 'o') and 'ontology' to refer to the philosophical and Knowledge Engineering senses respectively.

Gruber [Gruber, 1993a] defined an ontology as follows:

An ontology is an explicit specification of a conceptualisation.

This definition became the most quoted in literature and by the ontology community. Based on Gruber's definition, many definitions of what an ontology is were proposed. Borst [Borst, 1997] modified slightly Gruber's definition as follows:

Ontologies are defined as a formal specification of a shared conceptualisation.

Gruber's and Borst's definitions have been merged and explained by Studer and colleagues [Studer et al., 1998] as follows:

An ontology is a formal, explicit specification of a shared conceptualisation. Conceptualisation refers to an abstract model of some phenomenon in the world by having identified the relevant concepts of that phenomenon. Explicit means that the type of concepts used, and the constraints on their use are explicitly defined. Formal refers to the fact that the ontology should be machine-readable. Shared reflects the notion that an ontology captures consensual knowledge, that is, it is not private of some individual, but accepted by a group.

Since Ontologies are widely used for different purposes (natural language processing, knowledge management, e-commerce, intelligent integration of information, the Semantic Web, etc.) in different communities (i.e., knowledge engineering, databases and software engineering), Uschold and Jasper [Uschold and Jasper, 1999] provided a new definition of the word ontology to popularise it in other disciplines. Note that the database community as well as the object oriented design community also build domain models using concepts, relations, properties, etc., but most of the times both communities impose less semantic constraints than those imposed in heavyweight Ontologies. Uschold and Jasper defined an ontology as:

An ontology may take a variety of forms, but it will necessarily include a vocabulary of terms and some specification of their meaning. This includes definitions and an indication of how concepts are inter-related which collectively impose a structure on the domain and constrain the possible interpretations of terms.

Inside the case study there are different places where an ontology is needed, as is described on the conceptual architecture proposed in the Case study requirements :

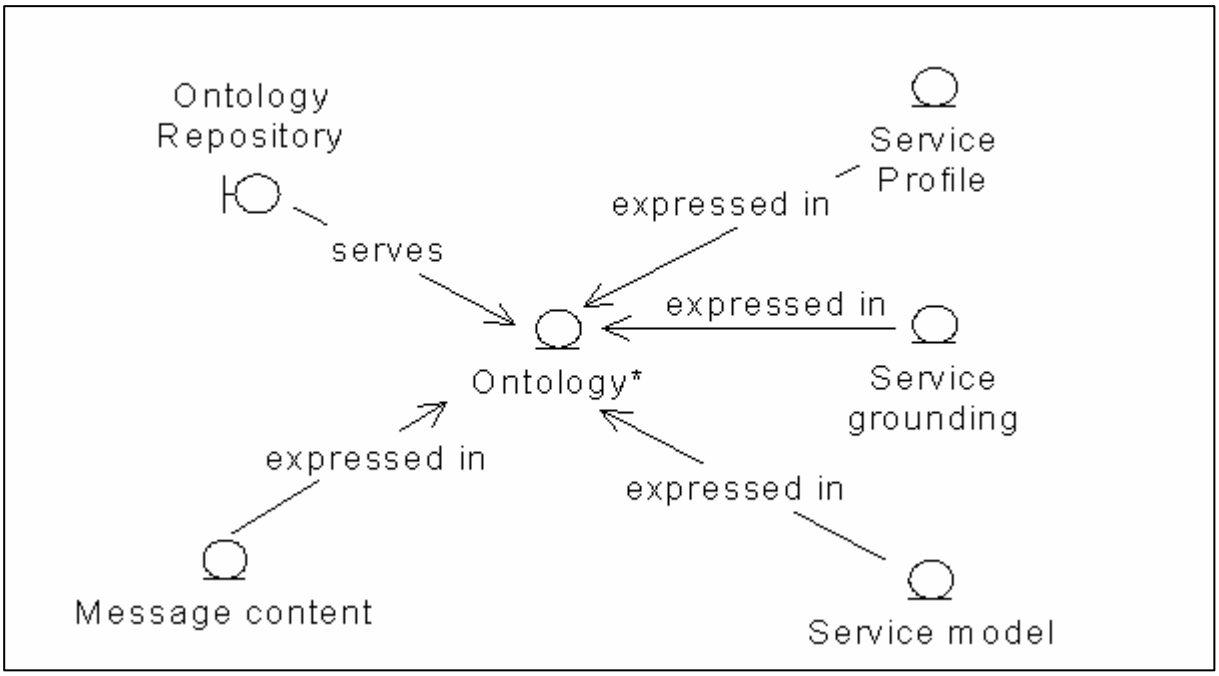


Figure 2 Conceptual Architecture - Ontologies

3.1 Scenario Storyboard

Actors and agents involved:

- Customer: C
- Banks: B_1, B_2, …, B_n
- Consumer goods companies (phone, natural gas, cable TV, whatever, …): E_1, E_2, …, E_n
- Customer Notification Agent, CAN
- Sentinel
- Estimation Services
- GETsee application (see as many Web Services)

Terminology:

- A_e, the estimated amount of some invoice at the end of a period associated with that invoice
- E_e, the consumer good company associated with the invoice. It is the source of the invoice and the later receiver of the amount of the bill.
- AB_e, the specific account where the invoice associated with A_e is going to be charged.
- B_e is the bank which account is going to be charged

- CB_e is the current balance of the account AB_e.

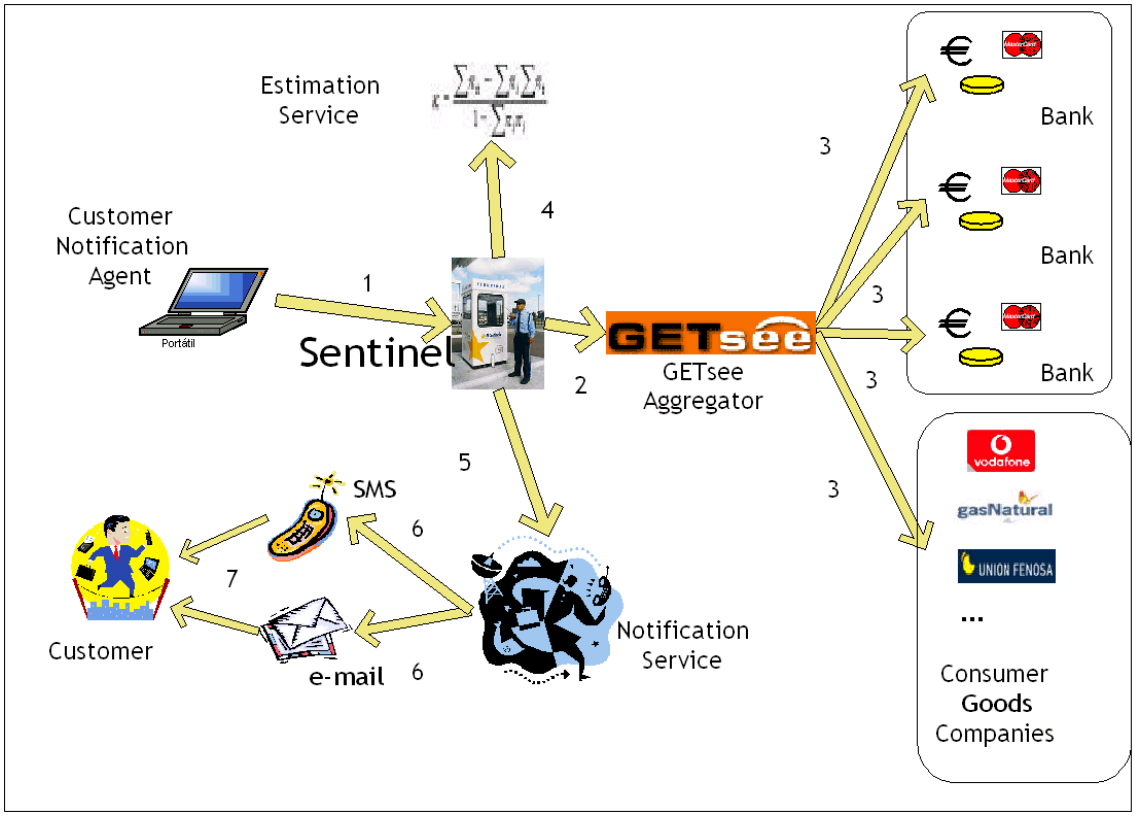


Figure 3 Storyboard Diagram

Step 1

Every day (the update frequency can be customized by the customer) an agent, running on behalf of a customer, dynamically configures and invokes the Sentinel Service. This agent, the Customer Notification Agent has all the customer's information needed for invoking the composed service (online username, password and other data)

Step 2

The Sentinel Service uses GETsee for collecting information from the customer's accounts.

Step 3

This Customer has decided, previously, to sign a contract with GETsee. GETsee is an application that allows to the customer to have all his personal online information about different banking or goods accounts in one only site. The way that GETsee gathers all the information and presents to the user is outside the scope of this case study. The interesting

thing is that GETsee can be viewed as a collection of Web Services and many of them can be, actually, invoked.

In GETsee, a customer can have in the same page the amount balance of all his accounts (of banks B_1, B_2, …, B_n). In one (or more) of this accounts some consumer goods companies, E_1, E_2, …, E_n can charge invoices. The invoices have some notification date and other (usually later) value date. The frequency of those invoices is, always, the same (weekly, monthly, bimonthly, annually).

Step 4

For each invoice of consumer goods companies, E_1, E_2, …, E_n, associated with the account, another Service (Estimation Service) estimate the probable amount (A) at the end of the period, A_e (estimated amount) in terms of heuristics or mathematical models. A_e has a relationship with a consumer good company E_e and a account of a bank AB_e. If the A_e is lesser than the established threshold for the account, then some alert has to be raised.

Step 5

The Notification Service looks in some unified (de)centralized registry different ways to communicate with the user. It can find different services involving many different devices (phone calls using VoIP, SMS, electronic mail, telegram) and personal data (phone number, cell phone number, e-mail, postal address). The services discovered have to have the ability to perform the action defined in the Notification Service.

Step 6

The invocation engine will sort in terms of cost, time to deliver, or any other attribute the different possibilities and choose the first service in this particular ranking. Some data mediation could be needed if terms of the Ontology used differ from the one used by the Notification Service.

If the service chosen has some irrecoverable mismatching of process or data, or some communication error occurs in the invocation, the service has to be able to choose another service (the next in the list) and invoke it.

Step 7

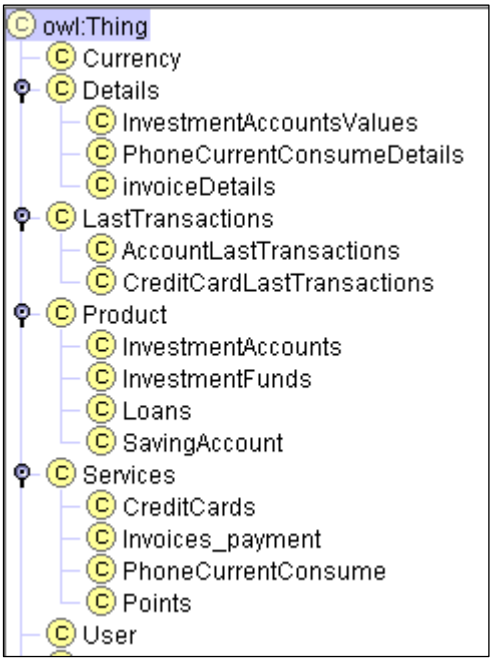
The service definitely chosen is invoked and some kind of notification to the user is made. The user, sooner or later, will be notified.

Watching this storyboard, different Ontologies are needed to express all the concepts, relationships and messages exchanged between the services and/or the applications.

3.2 Domain Ontologies

In this section we present the domain Ontologies which serves to model the domain of the GETSeeSWS Service and the other Services involved. We have named this Ontologies, „ProductDescriptions Ontology“, “Notification” and “Estimation”. These Ontologies have been developed by the authors of this deliverable, in charge of this case Study. We have described the Ontologies in OWL[8] using the Protégé Tool[9] , the OWL-plug-in [10] and the ezOWL plug-in[11] for graphical representation.

The ProductDescriptions Ontology follows the Ontology defined previously in D6.1, extended and fixed.



On the left we can see a glimpse of the Ontology (see Figure 4 Glimpse of the Ontology) built for this purpose. It serves as schema for interchanging messages between the Services.

In this domain Ontology we have depicted three different concepts to model. One is the ProductDescriptions Ontology which contains information about financial products and services, as well as Invoices details. Other ontology needed is the EstimationMethods which models different methods to estimate amounts correlating some arithmetical function or heuristics. At the end, we have needed to describe needed info for notify some message to a customer through some device using the contact information stored in someway. That Ontology is the ContactInfo.

Figure 4 Glimpse of the Ontology

Other providers (banks, consumer goods companies, SMS providers, etc.) could have been annotated in different Ontologies. Data Mediation will be necessary for understand the underneath meaning of the different concepts. Some mappings will be done between Ontologies in order to achieve the desired communication. For further details about Data Mediation, see Section Data Mediation)

These Ontologies have been modelled adding some characteristics and attributes not specifically relevant for this case study but they help to complete de domain modelled and can be used in further versions. However, we have not tried to model all the inherent characteristics of the domains and many aspects are missing, i.e. the financial and products could be thousands and can be classified in more detail.

We describe now some particularities of the design and model of the different Ontologies, using some examples to illustrate the concepts that we want to stick out:

A concept like *Product* can be modelled using the OWL Class construct.

```
<owl:Class rdf:ID="Product"/>
```

All the products defined in the ProductDescriptions Ontology as specialization of the *Product* Class can be modelled as subclasses of the *Product* class, i.e. The *SavingAccount* can be represented as a subclass of *Product*'s shown below:

```
<owl:Class rdf:ID="SavingAccount">
    <rdfs:subClassOf rdf:resource="#Product"/>
</owl:Class>
```

The # symbol signifies that this is an element already defined in the local namespace.

Financial products have a number of properties which can be divided into two categories: OWL Datatype Properties and OWL Object property. First one are those whom range is one of the XMLSchema types (string, float, int, boolean, date). OWL Object properties are those whom range is another class.

```
<owl:DatatypeProperty rdf:ID="product_id">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#Product"/>
</owl:DatatypeProperty>
```

```
<owl:ObjectProperty rdf:ID="holder">
    <rdfs:range rdf:resource="#User"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#InverseFunctionalProperty"/>
    <owl:inverseOf rdf:resource="#products"/>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#Services"/>
                <owl:Class rdf:about="#Product"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
</owl:ObjectProperty>
```

As we can see in the example above, a property could has a domain defined as the union of two different classes. I.e. the "holder" refers that a *User* could be holder of *Product* and *Services*.

3.2.1 ProductDescriptions Ontology

This Ontology describes the Financial Products and Services which are needed to express the Sentinel functionality.

Here are a list of the classes and subclasses that the ProductDescriptions Ontology represents:

- **Product**
  - Loans
  - Investment Accounts
  - Saving Account
  - Investment Funds

The class Product (see Figure 5 ProductDescriptions Ontology - Product) represents those Financial Products provided by a bank. In all of them the bank and the customer signs a contract in which the bank stores or lend money from or to the customer. The most important characteristic for define a financial product is the *interestRate* (it could be positive or negative). When the interest rate is positive, the bank give some money to the customer for having his or her money, but if the rate is negative, the customer pays some extra money for the money lent by the bank. All the products has a *product_id* which identify them uniquely. Each Financial Product (Loans, Investment Accounts, Saving Account and Investment Funds) has their own specific attributes. It has a *holder* relationship with the User concept. The cardinality of this relationship is n:n because each Product can be owned by many holders and vice versa, a User can own many different products.

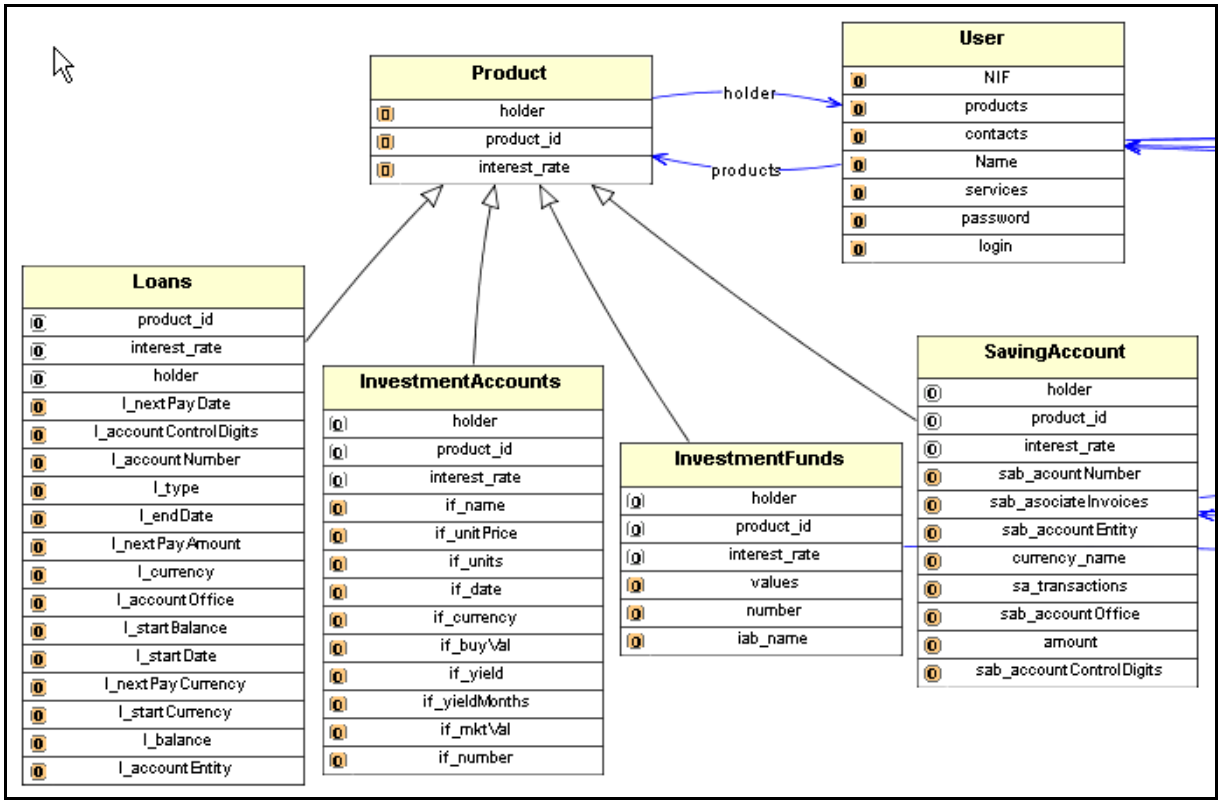


Figure 5 ProductDescriptions Ontology - Product

One of the Subclasses of the class Product, the SavingAccount (see Figure 6 ProductDescriptions Ontology - Saving Account), is an abstraction of saving accounts. It has many slots, used for representing an unique and structured way of identifying saving accounts. It has, besides two interesting relationships, *sab_associateInvoices* and *sa_transactions*. They represent which are the Invoices associated with this saving account and what have been the last transactions in the saving account, respectively. A Saving account has, besides a *amount* relationship with the Currency concept.

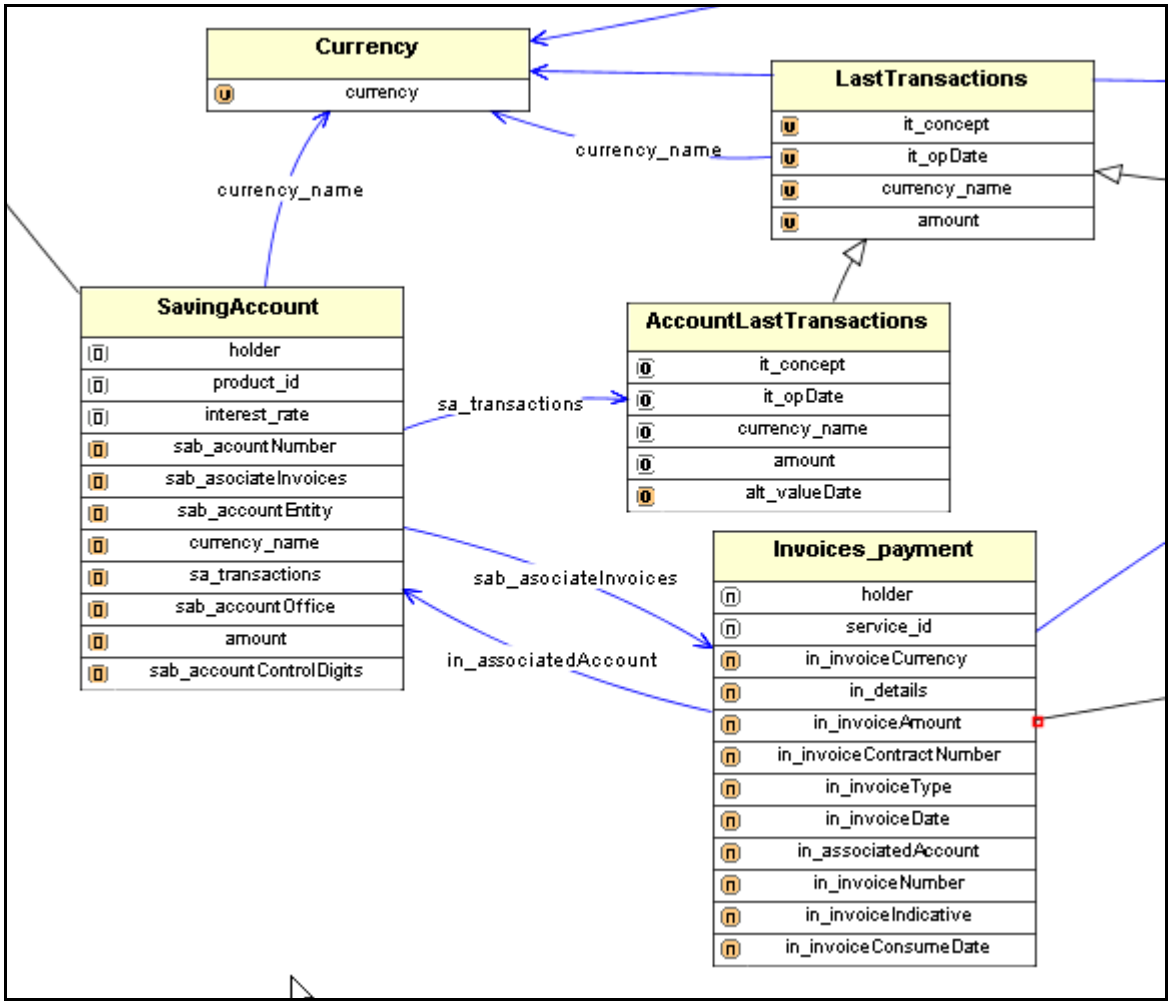


Figure 6 ProductDescriptions Ontology - Saving Account

- **Services**
  - CreditCards
  - Invoice_payments
  - PhoneCurrentConsume
  - Points

The class Services (see Figure 7 ProductDescriptions Ontology - Services) represents those Services that a bank could provide to their customers. These financial services provide added value to the relationship between a bank and their customers.

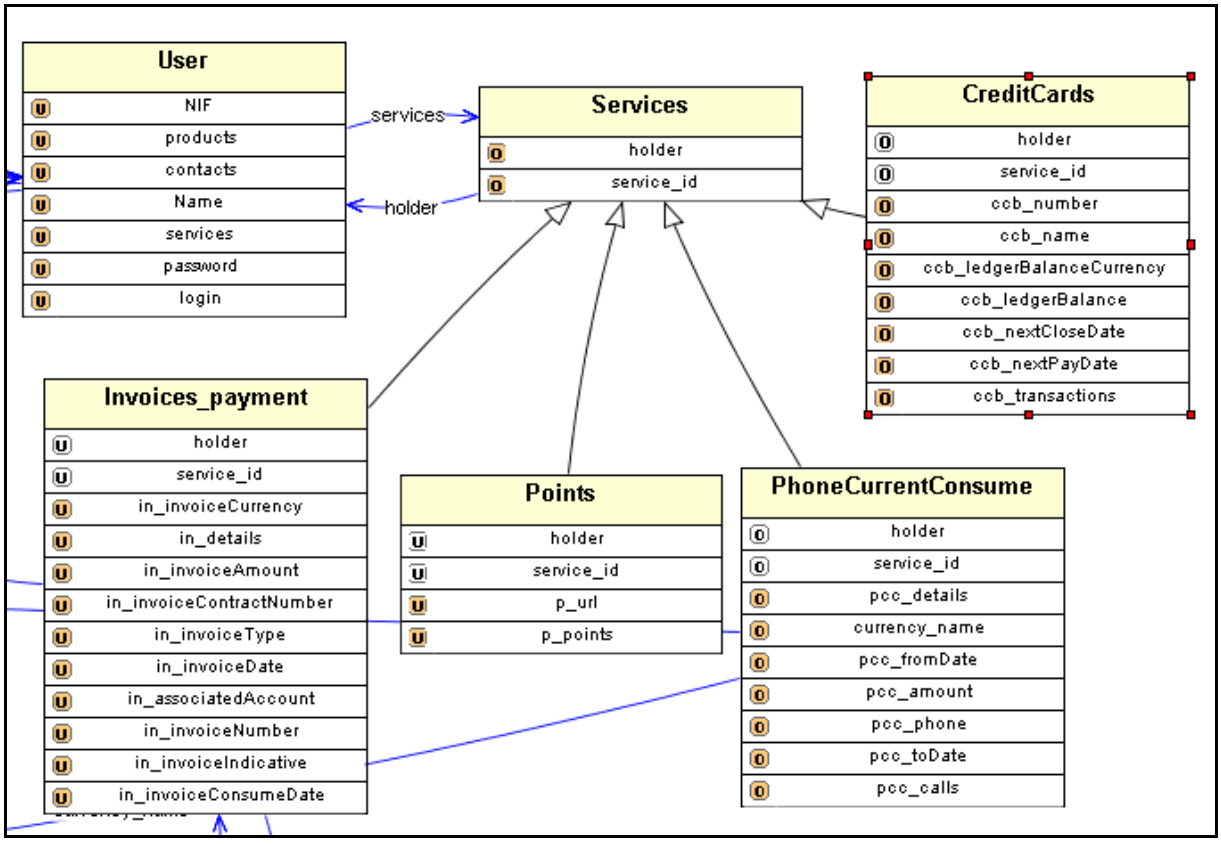


Figure 7 ProductDescriptions Ontology - Services

All the services have a *service_id* which identify them uniquely. Each Financial Service (Invoice_payment, Points, PhoneCurrentConsume and CreditCards) has their own specific attributes. It has a *holder* relationship with the User concept. The cardinality of this relationship is n:n because each Service can be owned by many holders and vice versa, a User can own many different services.

The class Invoices_payment (see Figure 8 ProductDescriptions Ontology - Invoices_payment) represents the service that the bank offers to their customers, allowing to charge, directly to a saving account of the customer the payment of many different things (taxes, shopping, subscriptions, consumer goods companies consumes like gas, water or phone)

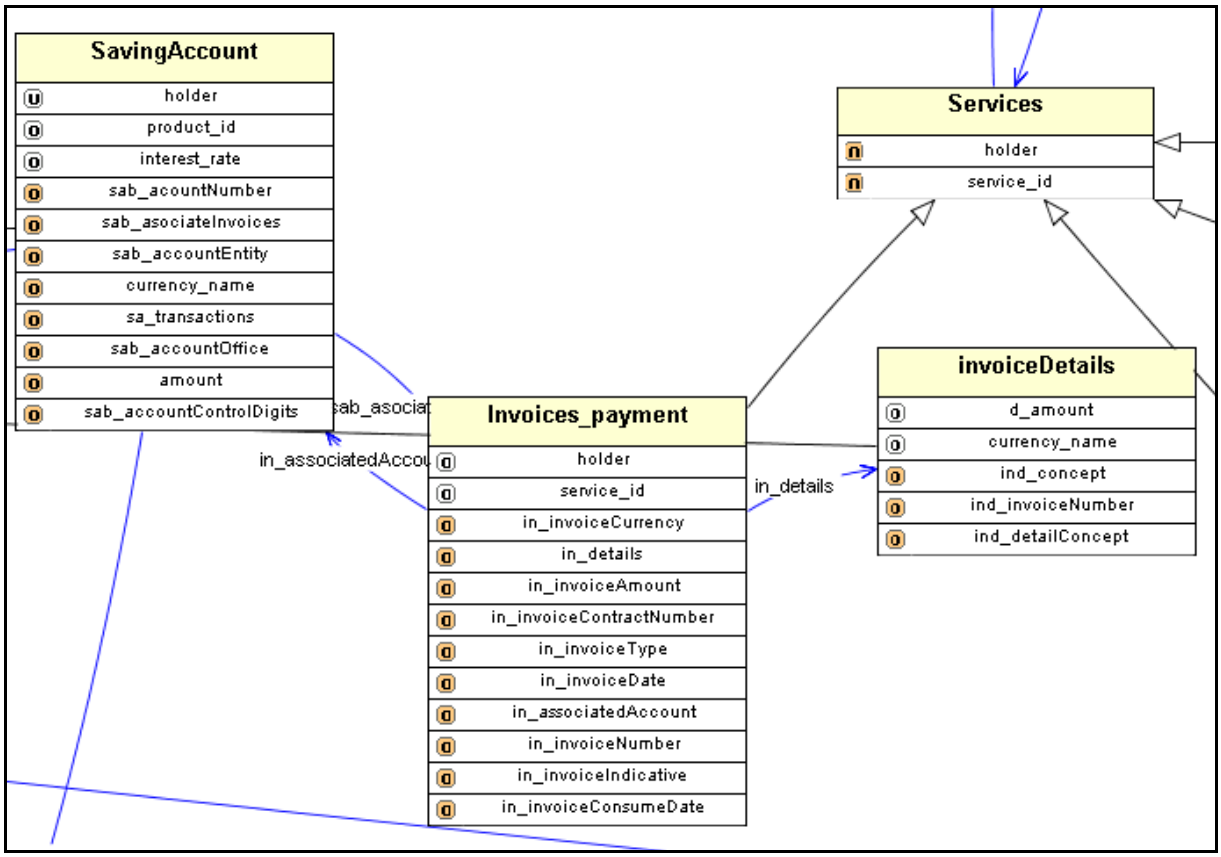


Figure 8 ProductDescriptions Ontology - Invoices_payment

The class Invoice_payment maintains a *in_details* relationship with the invoiceDetails concept. This relationship represents that an Invoice could have many concepts and different amounts and internal invoice numbers. The class invoiceDetails is a subclass of the concept Details which stands for the specific details that many services have.

- **User**

The class User (see Figure 9 ProductDescriptions Ontology - User) represent a customer of the bank and also customer of other companies which get money for the use of their services. Besides, the class User represents the specific notion that a User is also a human who can be addressed in some way. For that reason, a User has a relationship *contacts* with the concept ContactInfo. This relationship models that each User could be contacted for many ways, devices or channels (postal address, mobile phone, e-mail). The class User has, besides, relationships *products* and *services* with Products and Services, respectively. That means that a User could own one or more Products and Services and those Products and Services could be owned by more than one User.

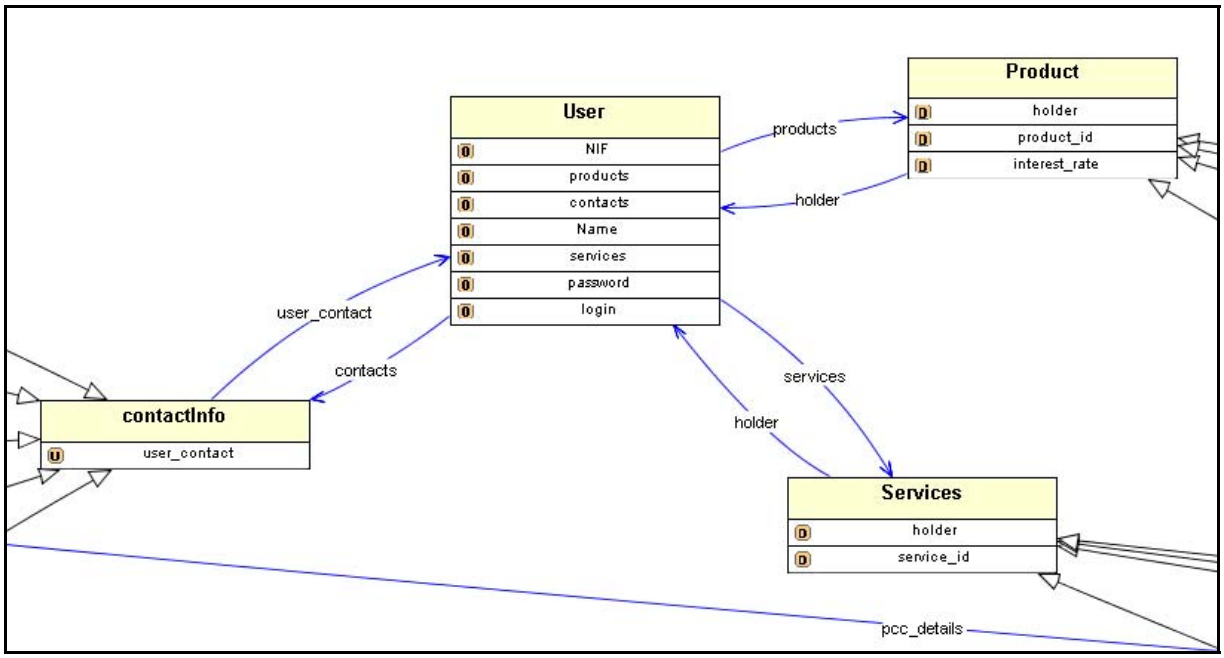


Figure 9 ProductDescriptions Ontology - User

The slots of the User class contains, besides, information to be used for logging purposes. These slots, *login* and *password* are taken for session Control.

- **LastTransactions**
  - AccountLastTransactions
  - CreditCardLastTransactions

The class LastTransactions (see Figure 10 ProductDescriptions Ontology - LastTransactions) models that some Product or Service (i.e. a Saving Account and a Credit Card) have frequent incomes and outgoes, called transactions and is better to model them with an specific class. Each LastTransaction has an amount (in a specific Currency) a Date and is identified by a description of its concept (it usually makes reference to the source of the transaction).

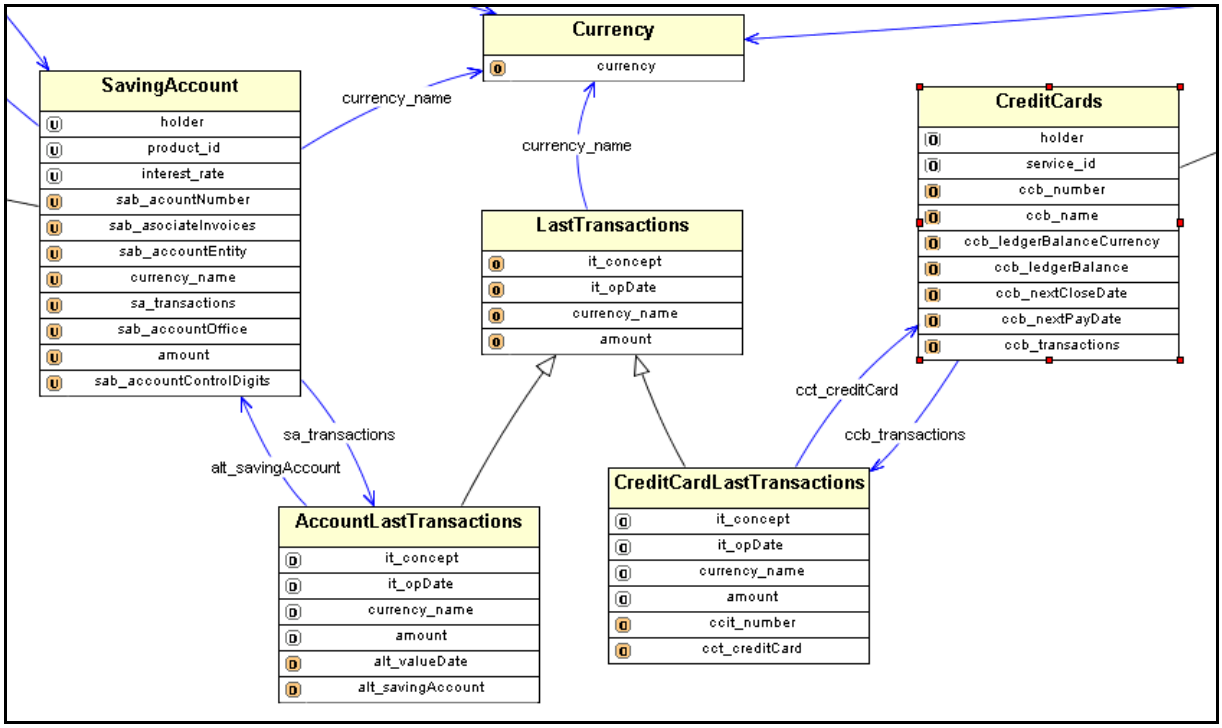


Figure 10 ProductDescriptions Ontology - LastTransactions

The class AccountLastTransactions represents transaction realized for a determined Saving Account. Otherwise, CreditCardLastTransactions stands for the transactions made by the using of a CreditCard.

- **Details**
  - InvoiceDetails.
  - PhoneCurrentConsumerDetails.
  - InvestmentAccountsValues.

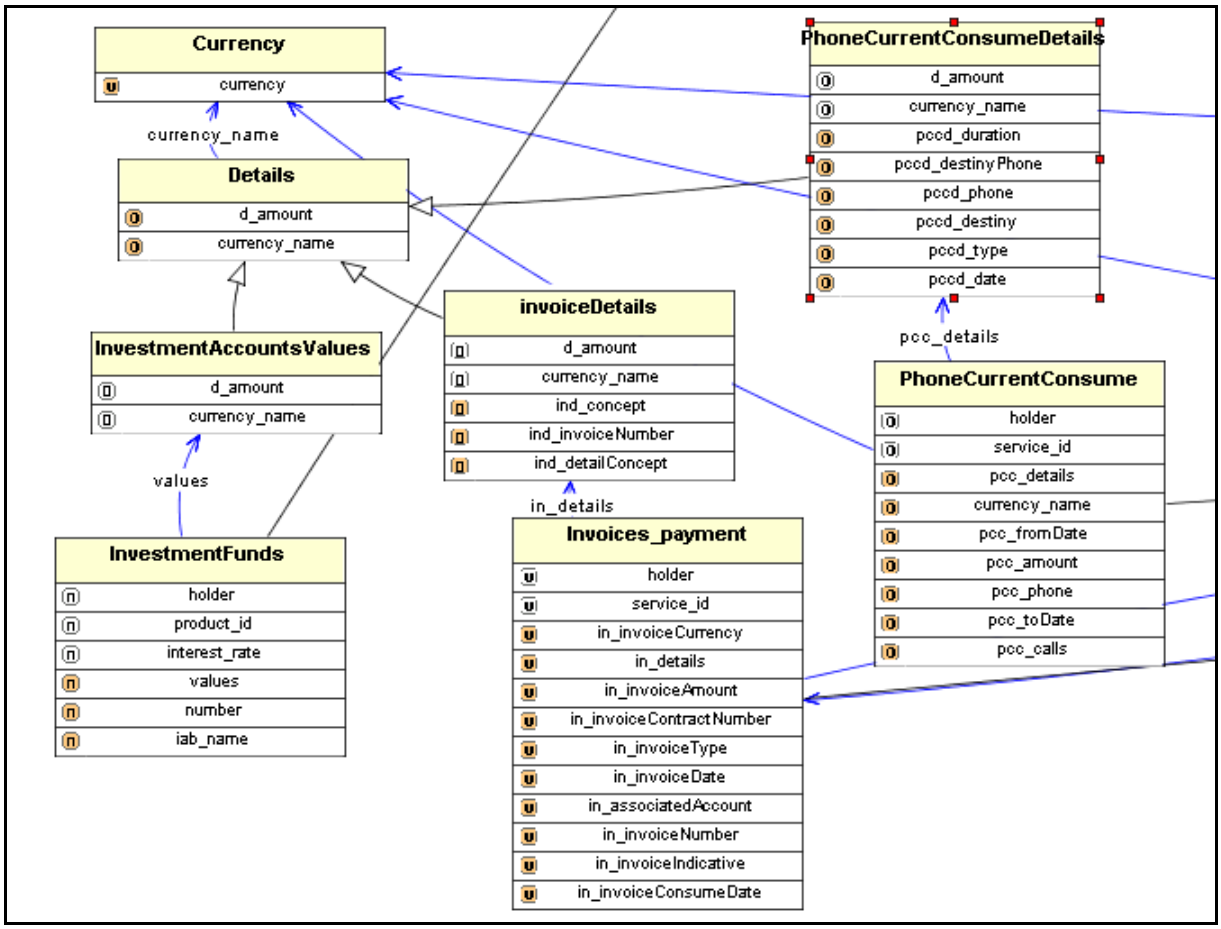


Figure 11 ProductDescriptions Ontology - Details

The class Details (see Figure 11 ProductDescriptions Ontology - Details) is an abstraction of the classes InvestmentAccountsValues, InvoicesDetails and PhoneCurrentConsumeDetails. The different subclasses specify the details of these particular products or services..

- **Currency**

The class Currency (see Figure 12 ProductDescriptions Ontology - Currency) represents the way in that an amount of money is modelled. Each amount of money (in Products, Services, Details, Transactions, etc.) has to be expressed in an concrete currency.

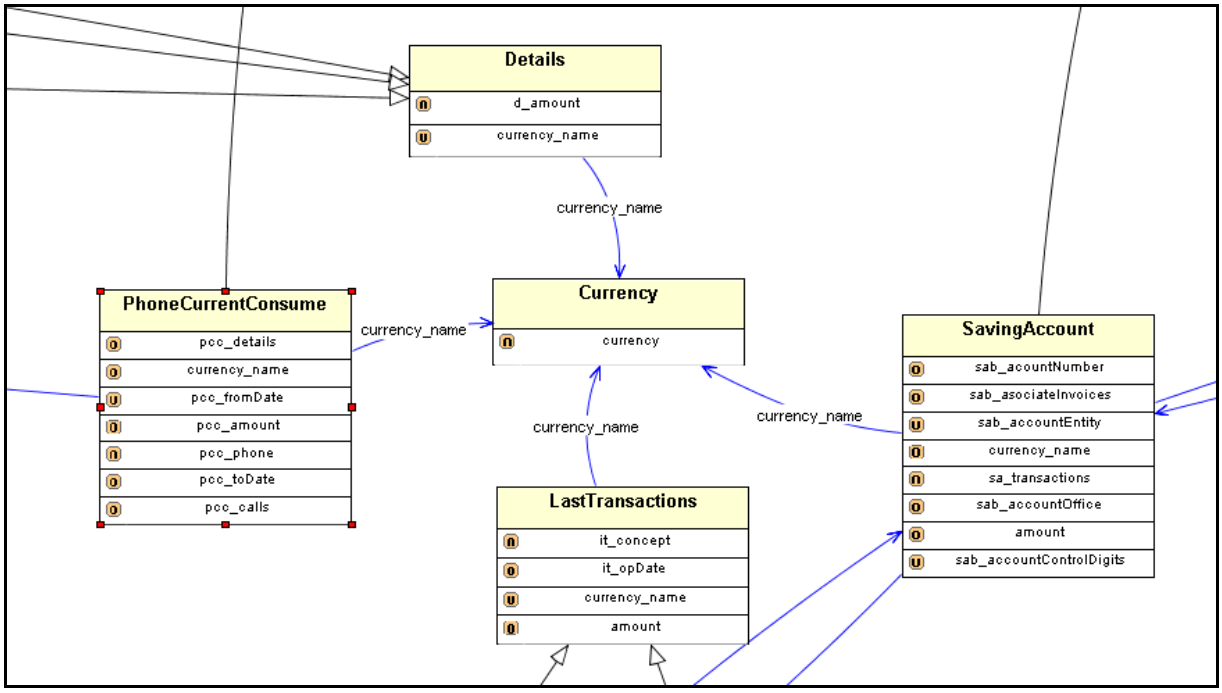


Figure 12 ProductDescriptions Ontology - Currency

3.2.2 Notification Ontology

The Notification Ontology has been defined to model the way in that a human can be contacted for communication purposes (excluding the human talk and other broadcasting services like commercials).

The overall diagram describes the relationship between the main concepts:

- Notification
- ContactInfo
- User
- Services

As we can see in the Figure 13 Notification Ontology - Overall Diagram, a *User* has a relationship with the *ContactInfo* class through the relationship *contacts*. A *User* is the *holder* of *Services*. A *Notification* is the action needed to notify a message (*ntf_body*) to a *User* by a *ntf_userToBeNotified* using a *ntf_usesContactInfo*.

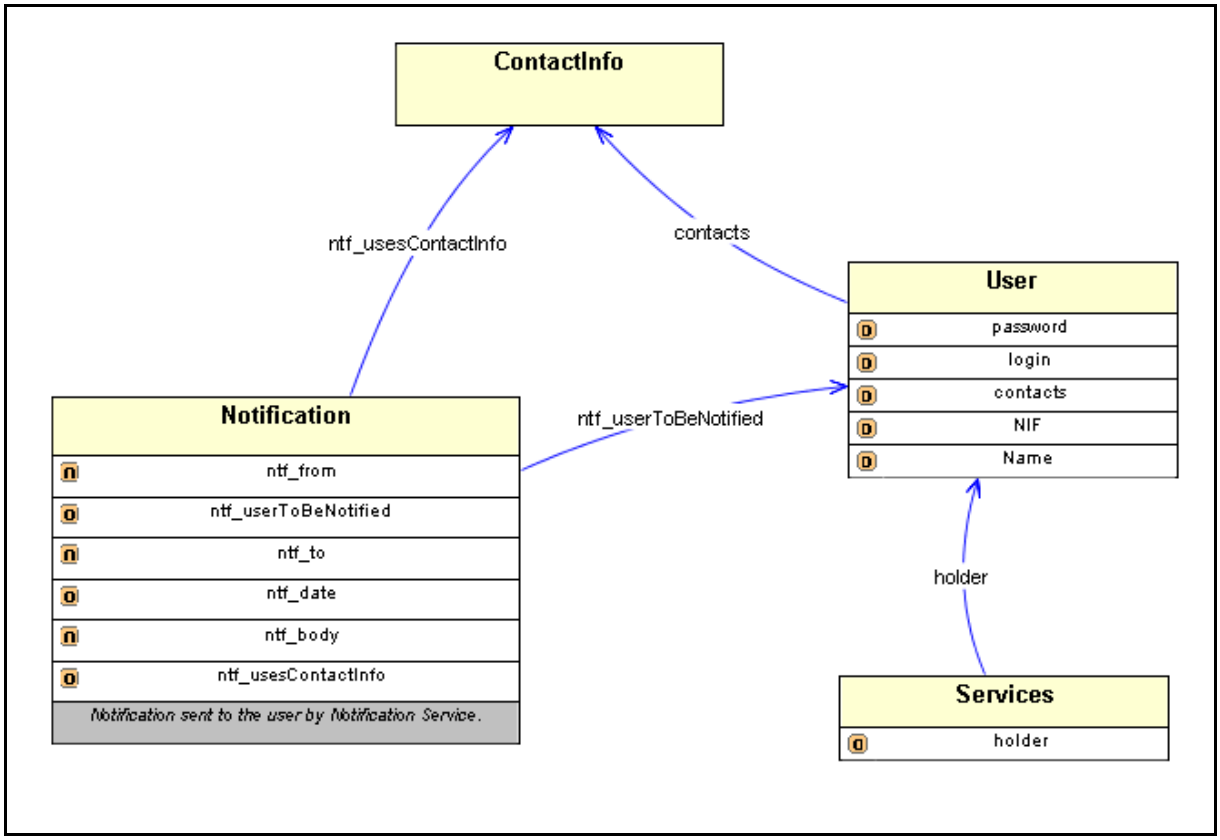


Figure 13 Notification Ontology - Overall Diagram

- **Notification**
  - NotificationByEMail
  - NotificationByFax
  - NotificationByPostalMail
  - NotificationByPhone
  - NotificationBySMS

The class Notification has the following slots for describe its behaviour:

- ntf_from: describes the source of the notification.
- ntf_userToBeNotified: relationship with the User which has to be notified.
- ntf_to: describes the destination of the notification (the name, title or whatever other needed data).
- ntf_body: The content of the notification.

- ntf_usesContactInfo: Relationship with the *ContactInfo* class. It models the information chosen to contact the *User*.

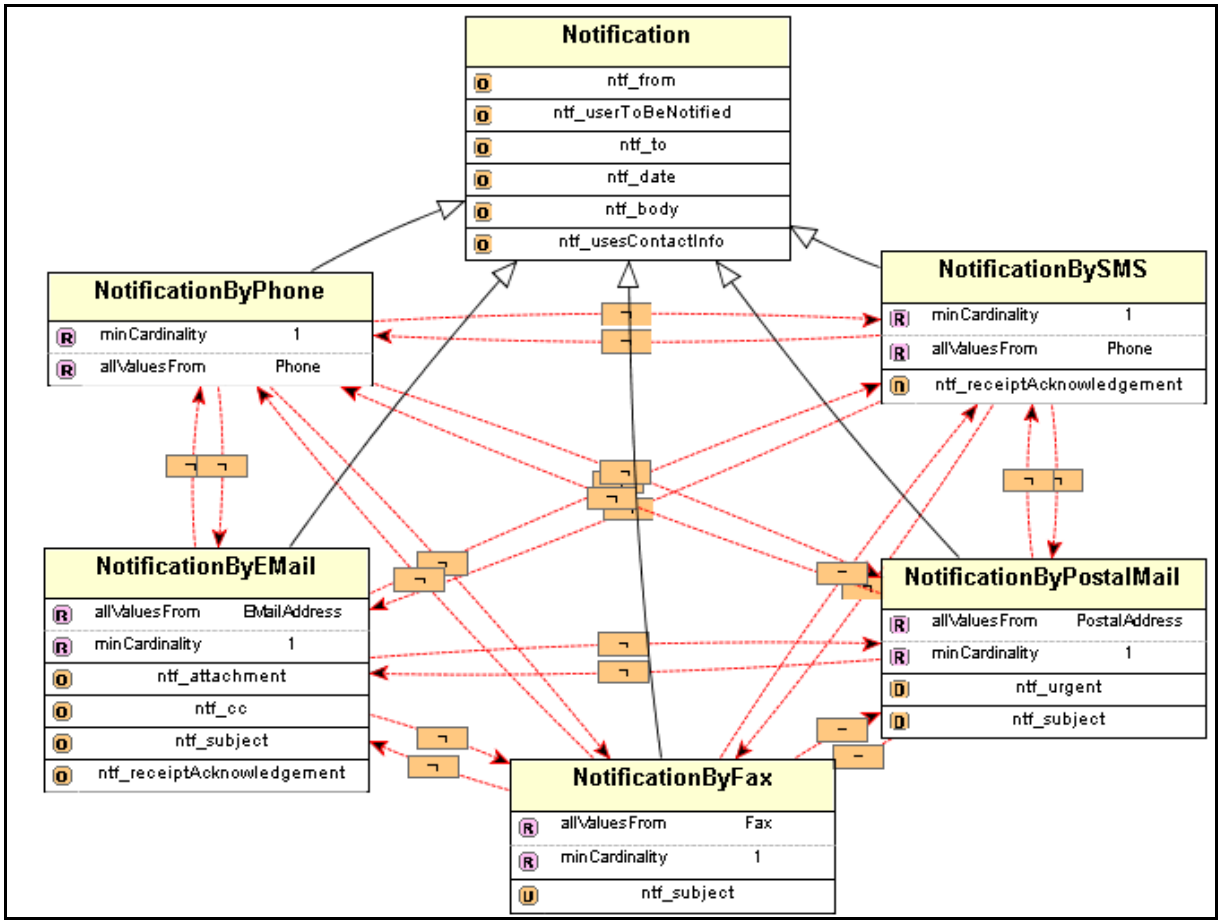


Figure 14 Notification Ontology - Notification Subclasses

As we can see in the Figure 14 Notification Ontology - Notification Subclasses, many subclasses of the Notification class have been defined. Each one describes a way to notify a *User*. Each *NotificationBy<whatever>* subclass is disjoint with the others, advertising the fact that a *NotificationByFax* can't be, besides a *NotificationByEMail*, and vice versa. This is, of course, a representation of the behaviour of the real world. If you want to communicate with someone sending him a Fax and an e-mail, the receiver will have two different communications, one in the facsimile device and the other in his e-mail inbox. Other useful condition is that the *ContactInfo* variable used for each subclass (through the *ntf_usesContactInfo* slot) has to be from a particular subclass of *ContactInfo*. I.e., all the values of the *ntf_usesContactInfo* of a *NotificationByEmail* class have to be of the *EmailAddress* class. That condition is modelled with the label *owl:AllValuesFrom.* See below an example:

```
<owl:Class rdf:ID="NotificationByFax">
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
        </owl:Restriction>
    </rdfs:subClassOf>
    <owl:disjointWith rdf:resource="#NotificationByPhone"/>
    <owl:disjointWith rdf:resource="#NotificationByPostalMail"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
            <owl:allValuesFrom rdf:resource="#Fax"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <owl:disjointWith rdf:resource="#NotificationByEMail"/>
    <rdfs:subClassOf rdf:resource="#Notification"/>
    <owl:disjointWith rdf:resource="#NotificationBySMS"/>
</owl:Class>
```

Each subclass has, besides that, more slots, describing its personal needs for communication with a *User*.

- **ContactInfo**
    - EmailAddress
    - PostalAddress
    - Phone
    - Fax

The class ContactInfo (see Figure 15 Notification Ontology - ContactInfo Diagram) models an abstract way of represent different kinds of Contact Information of a person (or an Organization). Illustrating the fact that a cellular phone number and an e-mail account are not the same and serve for different purposes, the ContactInfo subclasses (EmailAddress, PostalAddress, Phone and Fax) are disjoint ones with the others. See below the example of the Fax class in OWL.

```
<owl:Class rdf:ID="Fax">
    <rdfs:subClassOf rdf:resource="#ContactInfo"/>
    <owl:disjointWith rdf:resource="#EMailAddress"/>
    <owl:disjointWith rdf:resource="#PostalAddress"/>
    <owl:disjointWith rdf:resource="#Phone"/>
</owl:Class>
```

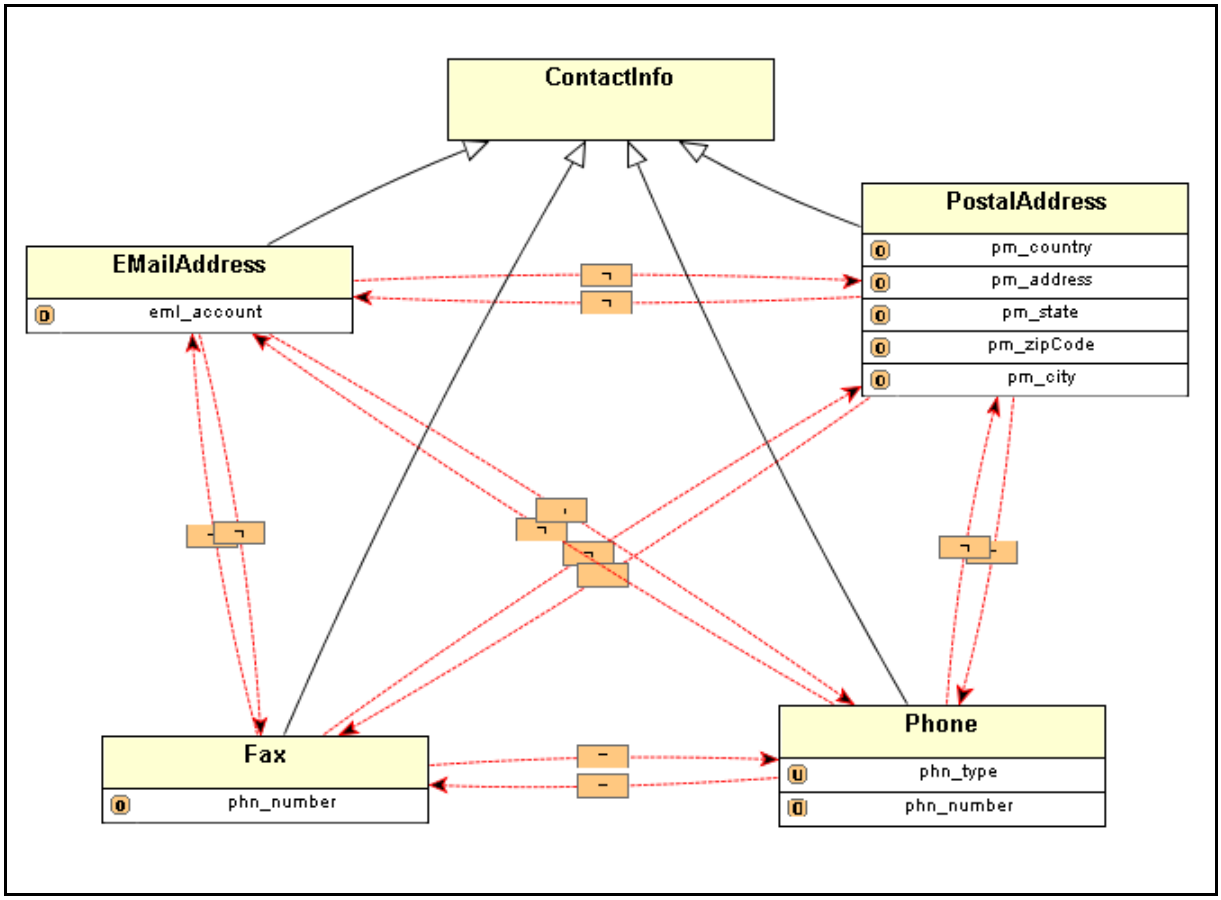


Figure 15 Notification Ontology - ContactInfo Diagram

3.2.3 EstimationParameter Ontology

The EstimationParameter Ontology (see Figure 16 EstimationParameter Ontology) describes the arithmetical functions used to estimate the amount of the spending of an invoice (or whatever other numerical concept which has an historical evolution).

We have only defined two subclasses of the EstimationParameter Ontology, attending to linear factors, but other more complicated functions (statistics, heuristics) could be described as well.

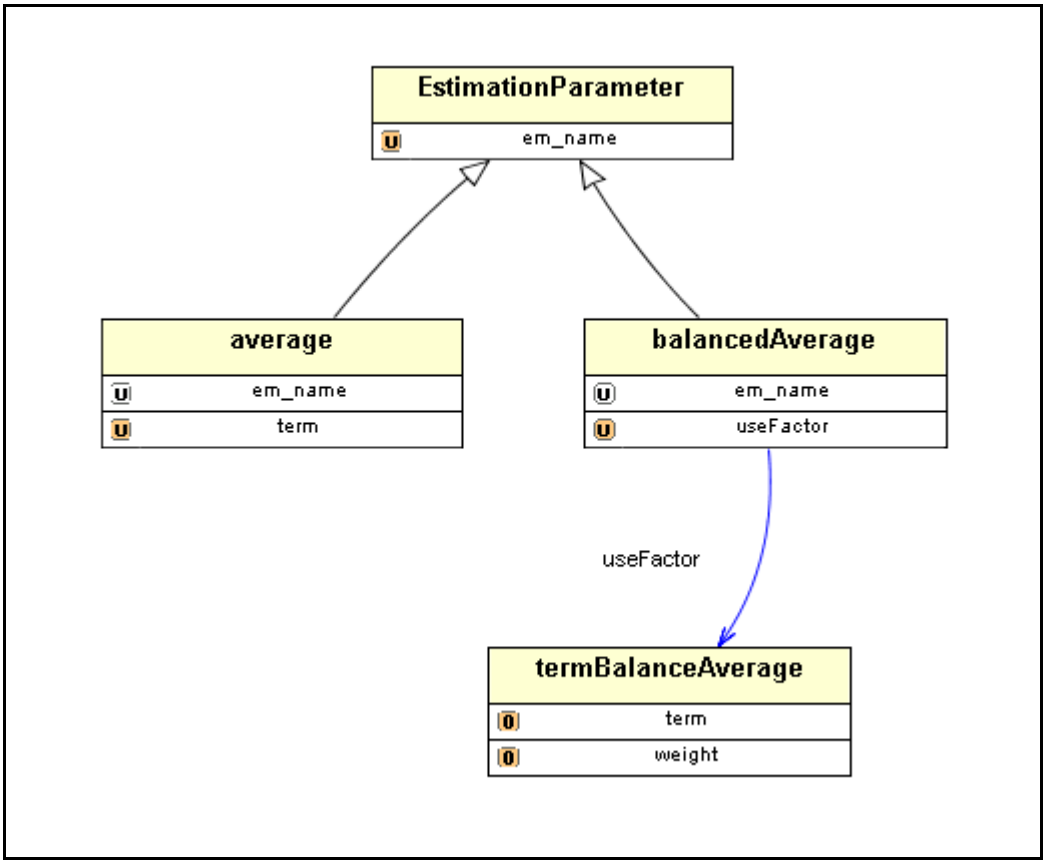


Figure 16 EstimationParameter Ontology

The *Average* Ontology is a subclass of the *EstimationParameter* class. It models the lineal average of different terms.

The *BalancedAverage* is also a subclass of the *EstimationParameter*. It models a different way to obtain an average. It has a relationship with the class *termBalanceAverage* which represents different terms and its own weight in the balanced arithmetical function. This is the *useFactor* relationship.

3.3 State Diagram Ontology

The functionality of the non-atomic processes could be decomposed in a structured (or not) set of atomic processes for performing the same task. This composition (or decomposition, viewed from the opposite) can be specified by using control constructs such as *Sequence* and *If-then-else*. Such a decomposition normally shows, among other things, how the various inputs of the process are acepted by particular subprocesses, and how its various outputs are returned by particular subprocesses. See below the definition of CompositeProcess in OWL-s 1.0:

```
<owl:Class rdf:ID="CompositeProcess">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Process"/>
    <owl:Restriction owl:cardinality="1">
      <owl:onProperty rdf:resource="#composedOf"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
```

A CompositeProcess must have a *composedOf* property by which is indicated the control structure of the composite, using a *ControlConstruct*

```
<rdf:Property rdf:ID="composedOf">
  <rdfs:domain rdf:resource="#CompositeProcess"/>
  <rdfs:range rdf:resource="#ControlConstruct"/>
</rdf:Property>
<owl:Class rdf:ID="ControlConstruct"/>
```

Each control construct, in turn, is associated with an additional property called *components* to indicate the ordering and conditional execution of the sub processes (or control constructs) from which it is composed. For instance, the control construct, *Sequence*, has a *components* property that ranges over a *ProcessComponentList* (a list whose items are restricted to be *ProcessComponents*, which are either processes or control constructs).

This property allows to manage the control flow of the execution of a CompositeProcess but, in counterpart bind the Domain Ontologies used in the Services to contain information about the Data and Control flow, and that not always is desirable.

For that reason, in our case study we have developed a mechanism to describe finite state machine (finite state diagram). The situation calculus introduces first-order terms called *situations*. The intuition behind the situation calculus is that the world persists in one state until an *action* is performed that changes it to a new state. Time is discrete, one action occurs at a time, time durations do not matter, and actions are irreducible entities. Actions are conceptualised as objects in the universe of discourse, as are states of the world. Hence, states and actions are reified. All changes to the world are the result of *actions,* which correspond to our atomic processes. The situation that holds on entry to an action is different to that which holds on exit. The exit situation is said to be the *successor* of the entry situation. Sequences of actions combine to form histories that describe composite situations – in essence the state that holds at the end of the sequence. Given this interpretation we can clarify the meaning of preconditions. A precondition is a condition that must be true of the situation on entry to an atomic process. However, sometimes these preconditions can not be computed in terms of the input, that is in terms of the domain ontology. That kind of preconditions are so-called *assumptions*.

So, speaking in terms of Semantic Web Services, each *state* can be seen as a situation, stable, after or before any *action*. The set of preconditions that must be true in this state are part of the preconditions of the atomic processes that make change that state. Following in this interpretation, transitions in the state diagram represent each atomic process needed for fulfil part of the goal, as is presented in Figure 17 State Diagram Ontology.

The State Diagram Ontology has the following classes:

- Condition

- State
  - End
  - Start
- Input
- Output
- Transition

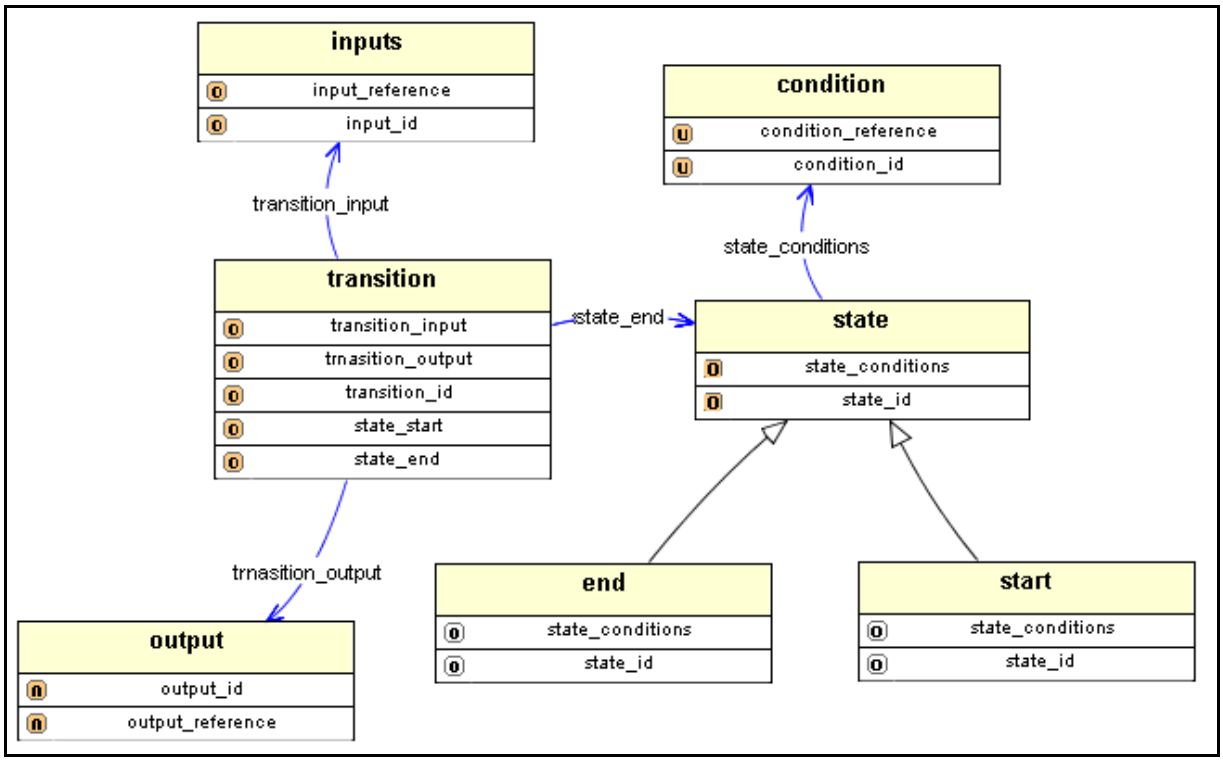


Figure 17 State Diagram Ontology

- **Condition**

At this very moment there are several efforts to describe preconditions, postconditions, effects and assumptions in the research area, but few consensus has been reached to determine a final good candidate (SWRL [13] , F-logic [14] , OWL[8] , DRS [15]). In order to describe our current needs we define a naïve solution to model conditions. Of course, making use of the reuse, we can import references to other conditions expressed in other Ontologies.

The class Condition represents conditions. That is, statements which can be true or false in a particular state of the world (depicted in the state diagram). These conditions could be expressed in the same way (in fact, they are exactly the same) that we use to describe conditions in Semantic Web Services. Conditions of an State are modelled as instances of this class (or subclasses defined by a Ontology designer). This class is defined as subclass

of […]Process.owl#Condition and […]Process.owl#Effect defined in the OWL-S Process Ontology for model conditions and effects. Using this technique, expressing conditions in the state diagram in the same way as in the Services will favor any attempt to matchmake Services with Transitions.

```
<owl:Class rdf:ID="condition">
    <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Condition"/>
    <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Effect"/>
</owl:Class>
```

- **State**

The class State models a state inside an state diagram. A state is represented as a node of the Graph which models a state machine. Each node is labelled with conditions, using the relationship *state_conditions*. Besides, each node is identified with an unique id, the slot *state_id*. A state in a Service Composition represents an intermediary step in the execution of two services.

```
<owl:Class rdf:ID="start">
    <rdfs:subClassOf>
        <owl:Class rdf:ID="state"/>
    </rdfs:subClassOf>
</owl:Class>
<owl:ObjectProperty rdf:ID="state_conditions">
    <rdfs:domain rdf:resource="#state"/>
    <rdfs:range rdf:resource="#condition"/>
</owl:ObjectProperty>
<owl:FunctionalProperty rdf:ID="state_id">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#state"/>
</owl:FunctionalProperty>
```

The states (when we are talking of an concrete State Diagram) are represented as instances:

```
<state rdf:ID="estimated">
    <state_conditions rdf:resource="#logged_in"/>
</state>
```

- **Input and Output**

The classes Input and Output defines the desired input and output of each transition. The specific inputs and outputs are modelled as subclasses of this classes. This is because the messages exchanged by the services (or viewed from the State Diagram point of view, the inputs needed for performing an action and the outputs derived from this actions) are, at last, classes or parts of some domain ontology. For a successful matchmaking it could be desirable Data Mediation for helping the Discovery Service to find services with similar inputs and outputs. The specific subclasses of Input and Output can be described in the same Ontology or they could inherit from other Ontologies (multiple inheritance) allowing to express the input and output of a Transaction in terms of the inputs and outputs of Services.

```
<owl:Class rdf:ID="input_Average">
    <rdfs:subClassOf rdf:resource="#inputs"/>
    <rdfs:subClassOf rdf:resource="http://users.isoco.net/~slosada/swws/Estimation.owl#Average"/>
```

</owl:Class>

The class represented above has the properties of the class Input (defined in the State Diagram Ontology) and the properties of the class Average (defined in the EstimationParameter Ontology) and it refers to the input needed for perform the estimate Service. This could be useful to the matchmaking because both uses the same Domain Knowledge. Another alternative approach could consider not having multiple inheritance and define, fully, the input_Average in a specific StateDiagram Ontology . In that case it could be necessary Data Mediation for performing the matchmaking.

- **Transition**

The class Transition models *actions* in a State Diagram. These actions are responsible for building a conversation in terms of the domain knowledge. From a stable situation (a state) and in presence of some conditions (which are true), some action is performed and some transition from the previous state to his successor is made. In a state diagram this transition is represented using an arrow from the starting state to the ending state. In a Composite Service framework, a Transition model the execution of an operation (in terms of Semantic Web Services this could be done by an Atomic Process or by another Composite Process).

The class Transition has the following attributes and relationships:

- State_start, State_end: They are the starting and ending state of the transition. They are instances of the class State. Each state is labelled with conditions which serve to refer to the preconditions and effect of the transition.
- Transition_input, Transition_output: Defines, in a domain ontology, the desired input and output for the transition. They references to subclasses of the class Input or Output (described before) or they could be a simple data type. This restriction makes mandatory the description of this ontology in OWL-full because OWL-DL doesn't allow this kind of description.

There are two special states labelled in a special way to denote what are the starting state and the ending state. Doing this, we always know what is the first subgoal which can be achieved and what is the final subgoal. With this information, some reasoning could be done forwards or backwards. To be able to transit from one state to another, the Discovery Service has to be able to find some Semantic Web Service with the same set of preconditions, effects, inputs and outputs (some data mediation could be needed) which has the instance of Transition representing the transition between the states in the following terms:

- Preconditions: These conditions label the starting state.
- Effects: They are the conditions presents on the ending state but missing in the starting state.
- Inputs: Define which part of the domain ontology need the service to be executed. Some data mediation could be needed if there are 3rd party services using another Ontologies.

- Outputs: Define which part of the domain ontology is the result of the execution of the service. Some data mediation could be needed if there are 3rd party services using another Ontologies.

For obtaining a more precise understanding of the relationship between the State Diagram and the Services (for the sake of matchmaking), see Figure 18 State Diagram of Sentinel

This is the state diagram which models the functionality of Sentinel. It could be easily translated to the State Diagram Ontology, previously described (see SentinelStateDiagram Ontology). With this ontology and the description of the Service, an agent could accomplish the task described with the state machine.

The agent will need to make some decision about what transition to take (i.e. what service has to execute) and some reasoner (with storage functionalities) will be needed to perform the control flow.

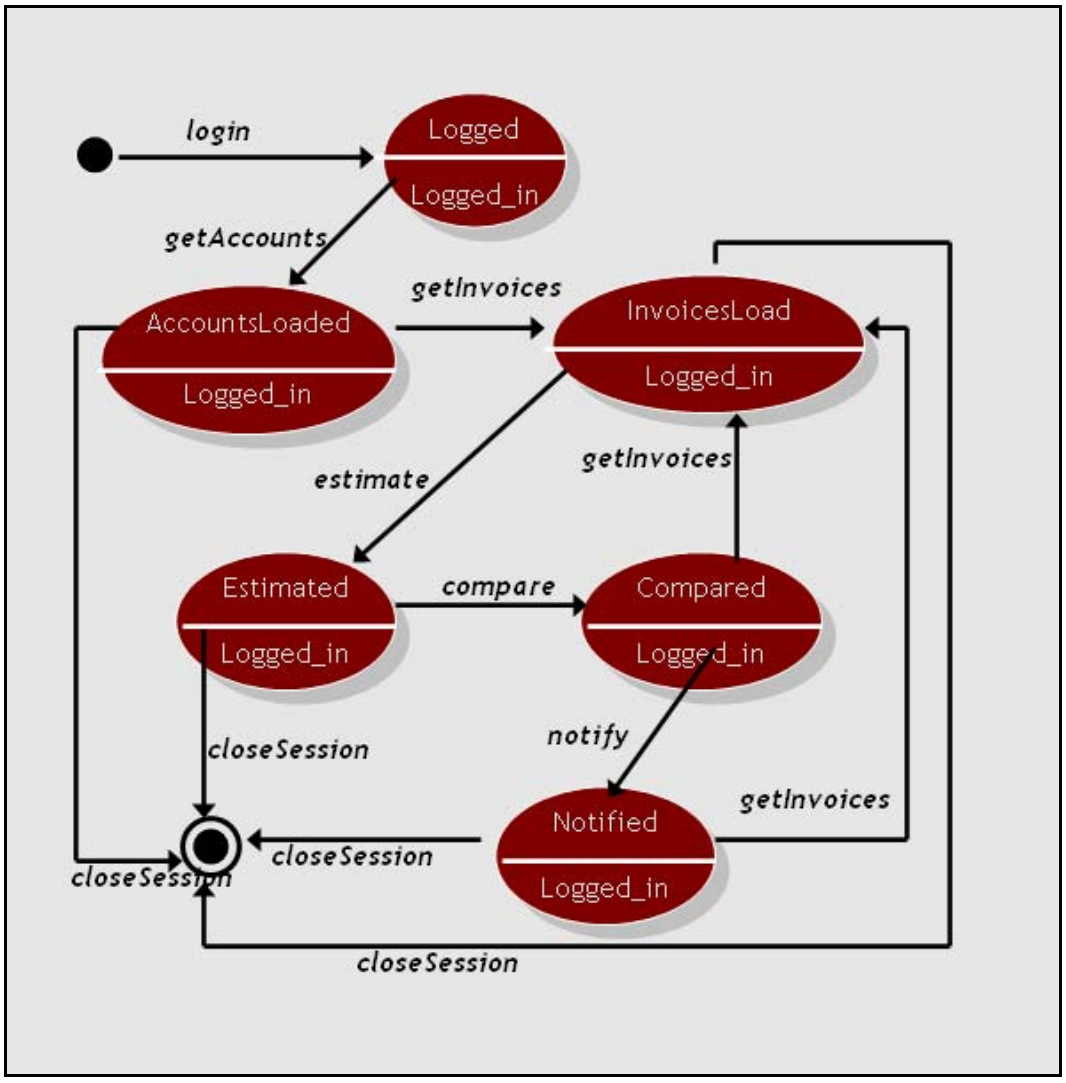


Figure 18 State Diagram of Sentinel

3.4 Data Mediation

Ontologies aim to capture consensual knowledge of a given domain in a generic and formal way, to be reused and shared across applications and by groups of people [16] . From this point of view, we could wrongly infer that there is only one ontology for modeling a domain. However, many Ontologies built by different people and with different purposes can reference the same knowledge.

Noy and Musen [17] defined Ontology alignment and merging as follows:

- *Ontology alignment* consists in establishing different kinds of mappings (or links) between two ontologies, hence preserving the original Ontologies.
- *Ontology merging* proposes to generate a unique ontology from the original ontologies

In the Semantic Web Services field, Data Mediation is needed when a Service, expressing some knowledge in some domain ontology, has to invoke another Service with, possibly, a different domain ontology. In this situation we need to express the knowledge expressed in the destination ontology some concepts defined in the source ontology, so the aim of the Data mediation is, precisely, the *Ontology alignment*.

The PROMPT method [18] (Noy and Musen, 2000) was ellaborated by the Stanford Medical Informatics group at Stanford University. The main assumption of PROMPT is that the ontologies to be merged are formalized with a common knowledge model based on frames.

This approach has been our inspiration for the Data Mediation in our Case Study. There are other possibilities trying to translate the content message exchanged into XML Schemas and express the mapping using XLST. But this approach limitates the expressivity on the complexity of the data exchanged.

4 Services

To describe the Semantic Web Services we have used OWL-S. We will explain some details of OWL-S and afterwards, we will detail the way in which we have annotated the services. We have built and annotated several Web Services, many of them have been grouped into a one more elaborated composite process. At the end, only three services are available:

- GETsee Service
- Notification Service
- Estimation Service

In the diagram of the Services (see Figure 19 Architecture Diagram of the Services) we have drawn the three services (GETsee, Notification and Estimation) and the Ontologies in which we have annotated them. Besides, in the figure, we see the decomposition of the GETsee Service into five Atomic Services (openSession, getAccounts, getInvoices, getBalance, closeSession). All this five Services are annotated using the same Ontology as the GETsee service (but this is not mandatory). Those atomic services invoke other services (annotated in other Ontologies). Some Data Mediation could be needed for the exchange of messages. At last, the Notification Service looks for Service able to notify something to a person and finds two services, annotated in, possibly, other two more Ontologies.

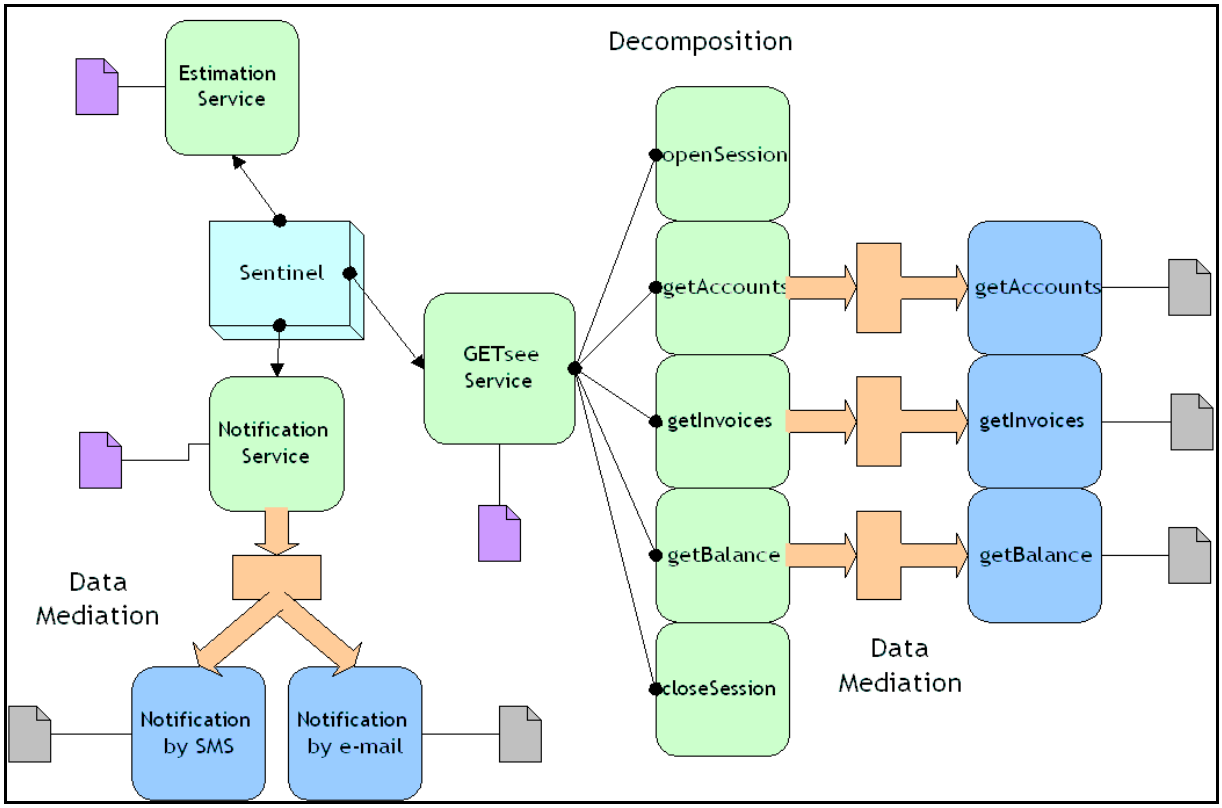


Figure 19 Architecture Diagram of the Services

4.1 Services Required

This section further develops the storyboard to include considerations of the services that are required and the messages that must be passed between them.

4.1.1 GETseeSWS_login

This service allows the login of a User in the application. This login is needed for performing any other task. The input need for the service is described in the ProductDescriptions Ontology as the class User. The output of the service is a xsd:boolean indicating if the login has been successful, or not.

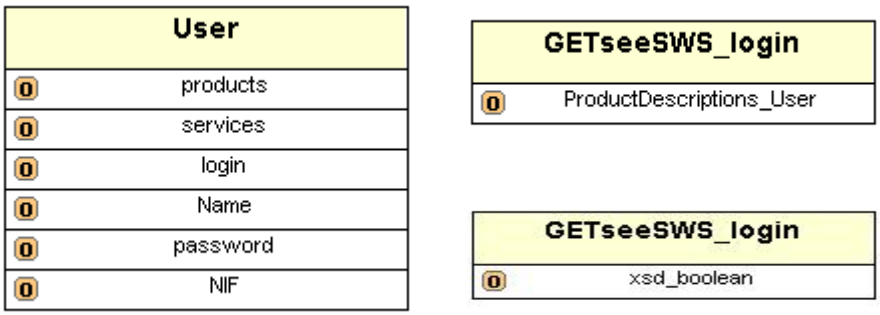


Figure 20 GETseeSWS_login input, output and class User

4.1.2 GETseeSWS_getAccounts

For obtaining the accounts, only a User is needed. The service will find these accounts (in the GETsee Databases, out of the scope of this Case Study). It will give as result of the service an list of instances of SavingAccount

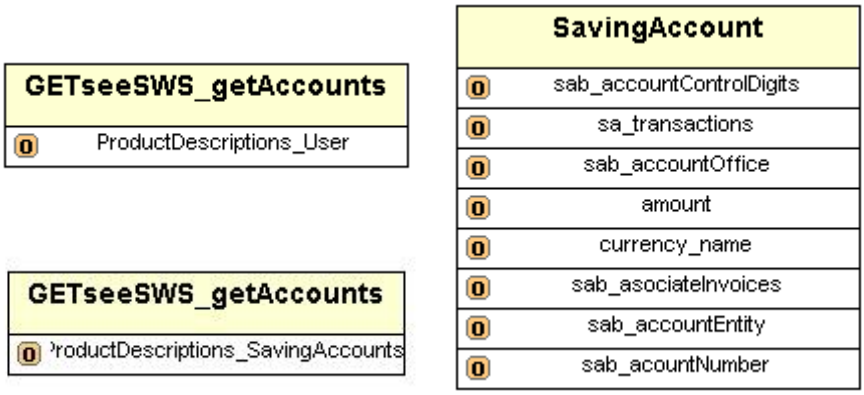


Figure 21 GETseeSWS_getAccounts input, output and SavingAccount

4.1.3 GETseeSWS_getInvoices

For obtaining the Invoices related to an Account, we need, precisely, an instance of SavingAccount and a User. The output of the service will be a list of Invoice_payments.

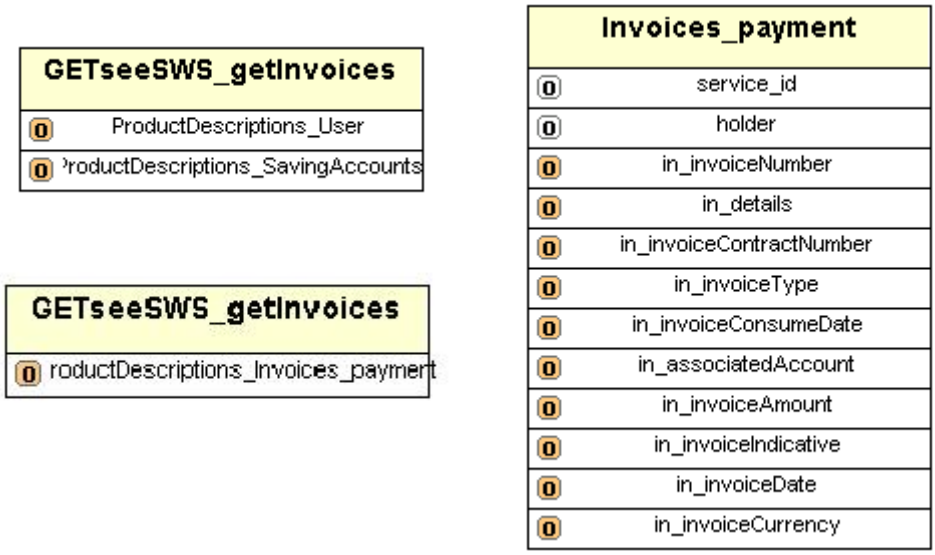


Figure 22 GETseeSWS_getInvoices input, output and Invoice_Payments

4.1.4 GETseeSWS_getBalance

The balance of an SavingAccount could be obtained with the User of the Account and the account itself. The output of the service is a xsd:float indicating the balance (positive or negative) of the account.

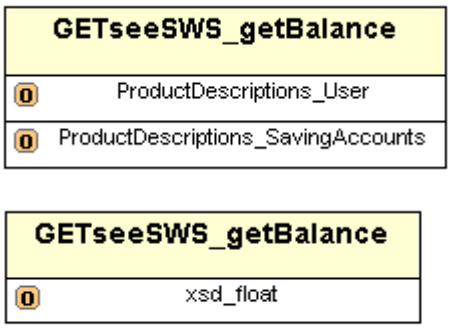


Figure 23 GETseeSWS_getBalance input and output

4.1.5 GETseeSWS_closeSession

The closeSession Service only need the User who has opened the Session. There is a boolean output indicating if the service has been successful or not.

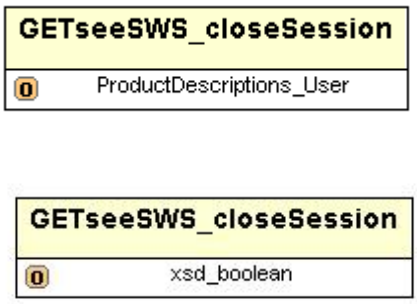


Figure 24 GETseeSWS_closeSession input and output

4.1.6 Notification

The Service of Notification needs the information of the User defined in the Notification Ontology.

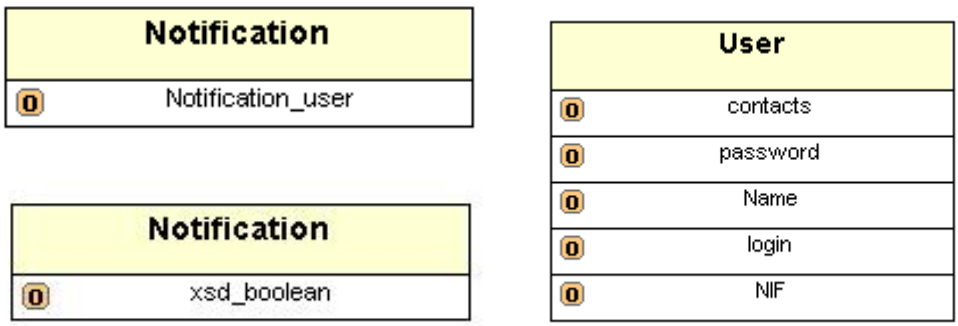


Figure 25 Notification input, output and User

4.1.7 Notification_sendMail

The Notification_sendMail service needs the body of the e-mail, the subject of the e-mail and someone to send him the e-mail. The expected output is a xsd:boolean indicating if the operation has been successful or not.

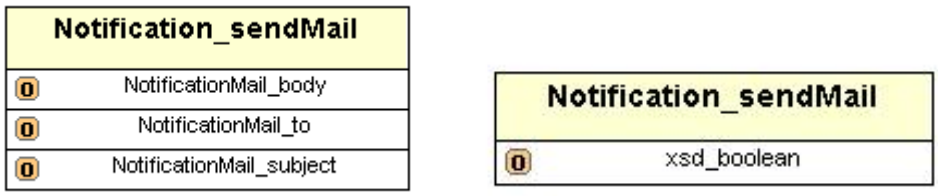


Figure 26 Notification_sendMail input and output

4.1.8 Notification_sendSMS

The Notification_sendSMS service needs, only, the number of the phone to send him an SMS. The expected output is a xsd:boolean indicating if the operation has been successful or not.

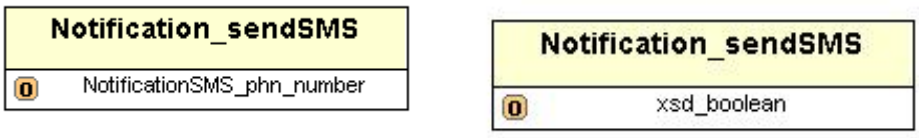


Figure 27 Notification_sendSMS input and output

4.1.9 Estimation

The Estimation service

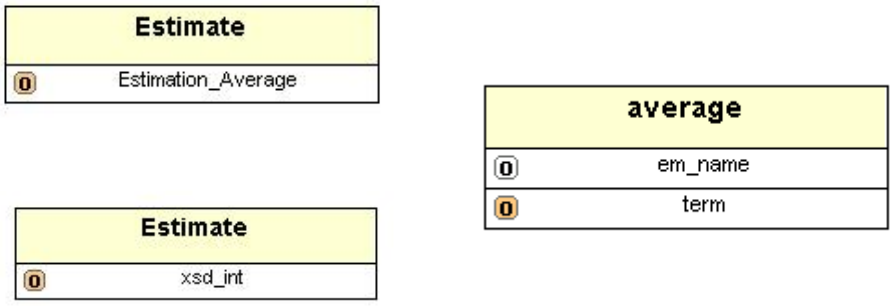


Figure 28 Estimate input, output and Average

4.2 OWL-S

The OWL-S Service (see Figure 29 Conceptual Diagram of OWL-S) is a formal definition of the service The OWL-S Profile supports the discovery process by providing a representation of capabilities of Web services and agents. The OWL-S *Process Model* and *Service Grounding* provide support for the interaction between the Discovery Service and the requester and provider of the service. The *Service Grounding* provides a mapping from the semantic form of the messages exchanged as defined in the Process Model, to the syntactic form as defined in the WSDL input and output specifications.

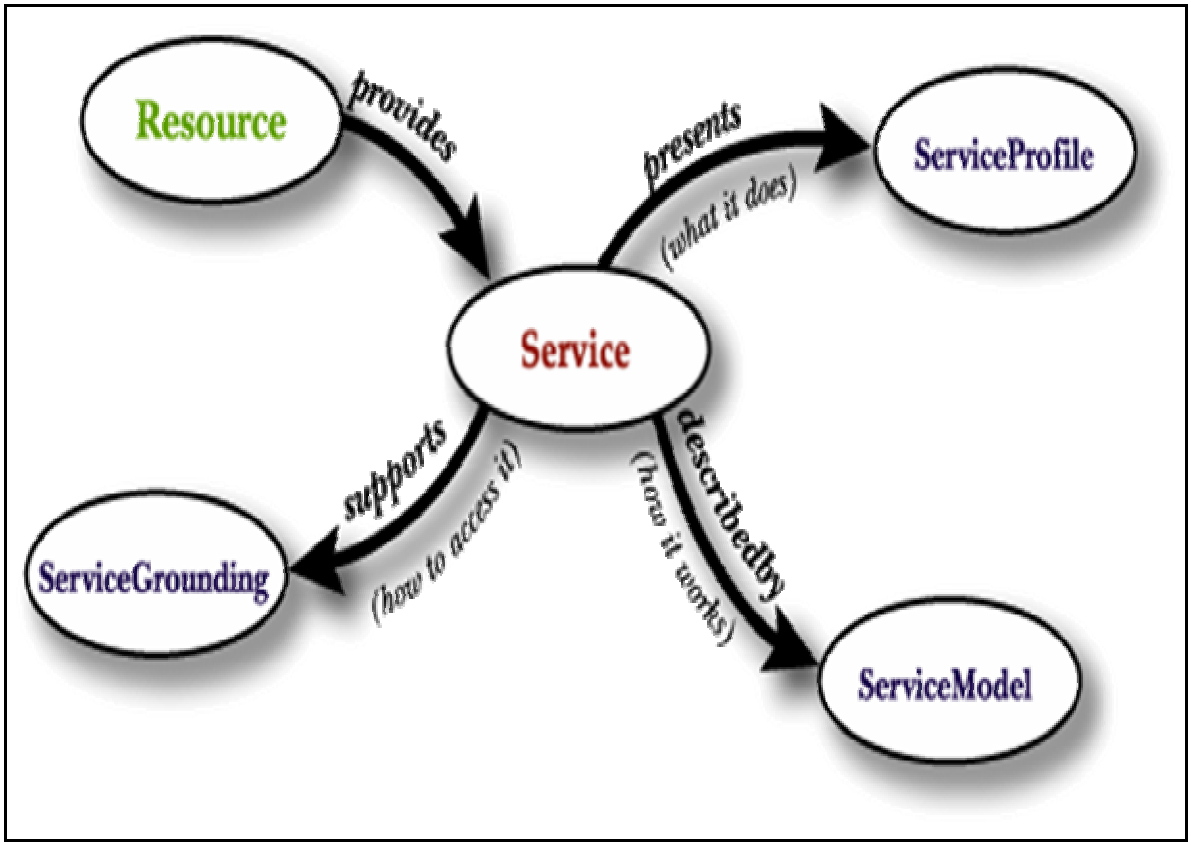


Figure 29 Conceptual Diagram of OWL-S

4.2.1 Service

The class *Service* provides an organizational point of reference for declaring Web services; one instance of Service will exist for each distinct published service. The properties *presents*, *describedBy*, and *supports* are properties of Service. The classes *ServiceProfile*, *ServiceModel*, and *ServiceGrounding* are the respective ranges of those properties. Each instance of Service will *present* a descendant class of *ServiceProfile*, be *describedBy* a descendant class of *ServiceModel*, and *support* a descendant class of *ServiceGrounding*

The upper ontology for services specifies only two cardinality constraints: a service can be described by at most one service model, and a grounding must be associated with exactly one service. The upper ontology deliberately does not specify any minimum cardinality for the properties *presents* or *describedBy*.

We can describe our own services using this OWL-S Service Description. For example, for the Atomic Processes composing the GETsee Service, these are the descriptions:

```
<service:Service rdf:ID="getseeSWSloginService">
```

```
        <service:presents rdf:resource="&my_profile;#GetseeSWSlogin"/>
        <service:describedBy rdf:resource="&my_process;#GetseeSWSloginProcess"/>
        <service:supports rdf:resource="&my_grounding;#getseeSWSloginGrounding"/>
    </service:Service>
    <service:Service rdf:ID="getseeSWScloseSessionService">
        <service:presents rdf:resource="&my_profile;#GetseeSWSCloseSession"/>
        <service:describedBy rdf:resource="&my_process;#GetseeSWScloseSessionProcess"/>
        <service:supports rdf:resource="&my_grounding;#getseeSWScloseSessionGrounding"/>
    </service:Service>
    <service:Service rdf:ID="getseeSWSgetAccountsService">
        <service:presents rdf:resource="&my_profile;#getseeSWSgetAccounts"/>
        <service:describedBy rdf:resource="&my_process;#getseeSWSgetAccountsProcess"/>
        <service:supports rdf:resource="&my_grounding;#getseeSWSgetAccountsGrounding"/>
    </service:Service>
    <service:Service rdf:ID="getseeSWSgetBalanceService">
        <service:presents rdf:resource="&my_profile;#getseeSWSgetBalance"/>
        <service:describedBy rdf:resource="&my_process;#getseeSWSgetBalanceProcess"/>
        <service:supports rdf:resource="&my_grounding;#getseeSWSgetBalanceGrounding"/>
    </service:Service>
    <service:Service rdf:ID="getseeSWSgetInvoicesService">
        <service:presents rdf:resource="&my_profile;#getseeSWSgetInvoices"/>
        <service:describedBy rdf:resource="&my_process;#getseeSWSgetInvoicesProcess"/>
        <service:supports rdf:resource="&my_grounding;#getseeSWSgetInvoicesGrounding"/>
    </service:Service>
```

4.2.2 Service Profile

The service profile tells ``what the service does''; that is, it gives the types of information needed by a Service Discovery (or matchmaking agent acting on behalf of a Service-seeking agent) to determine whether the service meets its needs. In addition to representing the capabilities of a service, the profile can be used to express the needs of the service-seeking agent, so that a matchmaker has a convenient dual-purpose representation upon which to base its operations.

The class *ServiceProfile* provides a superclass of every type of high-level description of the service. *ServiceProfile* does not mandate any representation of services, but it mandates the basic information to link any instance of profile with an instance of service.

Presents information about non-functional properties of the service:

- *serviceName*
- *textDescription*
- *contactInformation*

This information is human-readable and can not be automatically processed. More information could be easily extended using the *ActorDefault* properties defined in OWL-S[1].

[1] http://www.daml.org/services/owl-s/1.0/ActorDefault.owl

With this label, we can add structured information about the Contact information of the Provider of the Service.

```
<profile:contactInformation>
    <actor:Actor rdf:about="#Getinvoices_getsee">
      <actor:title> Service Representative </actor:title>
      <actor:phone>123 456 789 </actor:phone>
      <actor:physicalAddress>Madrid Spain </actor:physicalAddress>
      <actor:fax>123 456 789 </actor:fax>
      <actor:name>Getinvoices_Agent</actor:name>
      <actor:email>services@isoco.com</actor:email>
    </actor:Actor>
</profile:contactInformation>
```

An essential component of the profile is the specification of what functionality the service provides and the specification of the conditions that must be satisfied for a successful result. In addition, the profile specifies what conditions result from the service, including the expected and unexpected results of the service activity. The OWL-S Profile represents two aspects of the functionality of the service: the information transformation (represented by inputs and outputs) and the state change produced by the execution of the service (represented by preconditions and effects).

The Profile ontology defines the following properties of the Profile class for pointing to IOPE's:

- *hasInput*
- *hasOutput*.
- *hasPrecondition*
- *hasEffect*

One of the services we have described can be viewed in the following example:

```
<profileHierarchy:Getbalance rdf:ID="GetseeSWSgetBalance">
        <service:presentedBy rdf:resource="#GetseeSWSgetbalance"/>
        <profile:has_process rdf:resource="&pm_file;#getseeSWSgetBalanceProcess"/>
        <profile:serviceName>Getbalance_getsee </profile:serviceName>
        <profile:textDescription>Allow login in getsee aplication
        </profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Getbalance_getsee">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>Madrid Spain </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Getbalance_Agent</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasPrecondition rdf:ID="logged_in"/>
        <profile:hasInput rdf:resource="&pm_file;#getseeSWS_getbalance_user_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#getseeSWS_getbalance_acount_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#getseeSWS_getbalance_getbalanceReturn_OUT"/>
  </profileHierarchy:Getbalance>
```

These functionalities are analyzed by the matchmaking process to denote compatibilities within the user requirements. Input and Output indicate to the requester what information is needed in order to invoke the service and what is the expected result of the execution of the

service. In the previous example, the *GETseeSWSgetBalance* is a service to obtain information about the balance of a customer account. The input needed for this service is the user account login and the identificator of the account (a user can have more than one account in a bank). The expected output of the service is the balance of the account.

As precondition for the service, it has to be ensured that the user has been previously logged in. Although some post-condition could be annotated for a service, in this example none has been necessary. The input, output and preconditions are used by the requester to filter the possible results of a matchmaking service.

4.2.2.1 Profile Hierarchy

OWL-S does not prescribe or limit the ways in which profiles may be used, but rather, seeks to provide a basis for their construction that is flexible enough to accommodate many different contexts and methods of use.

In general, this kind of service characterization must effectively *position* a service within the broad array of services that exists within some domain, or perhaps in the world at large. One very natural technique for this kind of positioning is the construction of a class hierarchy, with inheritance of properties by subclasses. This fundamental technique, which is a familiar part of object-oriented design and programming, is also well supported by OWL and other description logic-based mark-up languages. This technique, when used to construct a hierarchy of subclasses of the *Profile* class, provides a useful means of constructing a "yellow pages" style of service categorization, but with more formal structure than is typically used in yellow pages, and thus supporting more powerful forms of query.

In our Case Study, we have used the hierarchybank.owl example of OWL-S. Inside this Hierarchy of Services many classes have been defined in a taxonomy-like structure. Using this taxonomy, an agent could discover a service defined as a subclass of an existent class of the hierarchy. For our case study we have built an ontology for classifying our services.

In hyerarchybank.owl we have an extremely simple example of this kind of class hierarchy. This is a limited example, intended only to provide *Profile* subclasses under which *GETseeSWS* examples can be categorized, and to illustrate inheritance of properties and multiple inheritance.

The getBalance class is an example of a inherited class inside a hierarchy:

```
<owl:Class rdf:ID="Banking_op">
   <rdfs:subClassOf rdf:resource="&profile;#Profile"/>
</owl:Class>
<owl:Class rdf:ID="Getinfo">
   <rdfs:subClassOf rdf:resource="#Banking_op"/>
</owl:Class>
<owl:Class rdf:ID="getBalance">
   <rdfs:subClassOf rdf:resource="#GetInfo">
   </rdfs:subClassOf>
</owl:Class>
```

4.2.3 Process Model

The service model tells ``how the service works''; that is, it describes what happens when the service is carried out. The primary kind of entity in the Process Ontology is, a *process*. OWL-S 1.0 adopts two views of processes. First, a process produces a data transformation from a set of inputs to a set of outputs. Second, a process produces a transition in the world from one state to another. This transition is described by the preconditions and effects of the process. A process can have any number of inputs, representing the information that is, under some conditions, required for the execution of the process. It can have any number of outputs, the information that the process provides, conditionally, after its execution.

Class *Process* has related properties *hasParameter*, *hasInput*, *hasOutput*, *hasPrecondition*, and *hasEffect*, which range over classes *Parameter*, *Input*, *ConditionalOutput*, *Precondition*, and *ConditionalEffect*, respectively.

The *atomic* processes are directly invocable. Atomic processes have no subprocesses, and execute in a single step, from the perspective of the service requester.

Here we have an example of an atomic process:

```
<process:Input rdf:ID="getseeSWS_getbalance_user_IN">
    <process:parameterName>getseeSWS_getbalance_user_IN</process:parameterName>
    <process:parameterType rdf:resource="&sentinel;#login"/>
</process:Input>
<process:Input rdf:ID="getseeSWS_getbalance_acount_IN">
    <process:parameterName>getseeSWS_getbalance_acount_IN</process:parameterName>
    <process:parameterType rdf:resource="&sentinel;#product_id"/>
</process:Input>
<!--Outputs-->
<process:Output rdf:ID="getseeSWS_getbalance_getbalanceReturn_OUT">
    <process:parameterName>getseeSWS_getbalance_getbalanceReturn_OUT</process:parameterName>
    <process:parameterType rdf:resource="&xsd;#long"/>
</process:Output>
<!--Process-->
<process:AtomicProcess rdf:ID="getseeSWS_getbalance">
    <process:hasPrecondition rdf:resource="#logged_in"/>
    <process:hasInput rdf:resource="getseeSWS_getbalance_user_IN"/>
    <process:hasInput rdf:resource="getseeSWS_getbalance_acount_IN"/>
    <process:hasOutput rdf:resource="getseeSWS_getbalance_getbalanceReturn_OUT"/>
  </process:AtomicProcess>
```

In this case, we have defined an atomic process which output is the balance of one of the accounts of the customer. This process can be used forming part of another service, a composite process. This process model has its inputs and outputs described in the domain ontology as well as the conditions, which we explore in a subsequent section. In the description of the input is remarkable that the parameterType can be some kind of XML Schema primitive type or an instance of a class defined in the domain ontology. Each atomic process has to be described also in the grounding, this let the message layer build the messages needed for the execution of the service. The URI of each atomic process is referenced from the grounding.

In the following section, we will study in much more detail this description.

Each referenced service described in the Service Description (using the *describedBy* relationship) has to be declared as an instance of the processModel. In this Ontology, we define instances of the processModel class, each one referenced in the Service Description.

4.2.3.1 Expressing conditions

Conditions have a pervasive presence in OWL-S. They are used to describe outputs and effects that result from the execution of processes. They are also used in the specification of constructs such if-statements and loops (see below).

OWL-S 1.0 does not mandate any language for expressing conditions at present, leaving to the modeler the task of deciding which rule language to adopt. Neither does OWL-S 1.0 make expressivity claims nor mandate a specific kind of logic for the rule language. The two main candidates currently are the Semantic Web Rules Language (SWRL), under development at W3c, and DRS, as described by Drew McDermott in an appendix of the OWL-S 1.0 release (as described in [15]). Another approach could be seen in the WSMO [2] project, expressing the conditions in F-logic [14] .

We have tried to express conditions in the Process Model as classes (and instances). In the following example we just define a condition to express that the customer has to be logged in before accomplish any of the other operations described in the service:

```
<process:Effect rdf:ID="logged_in">
    <process:ConditionalEffect>
        <process:ceCondition rdf:resource="#message_flag_error_false"/>
        <process:ceEffect rdf:resource="#logged_in"/>
    </process:ConditionalEffect>
</process:Effect>
```

As we can observe, *logged_in* is, at the same time, condition and effect. When a costumer performs the login operation, *logged_in* is the effect of the service, but in other services *logged_in* is a precondition to perform the task. Using this chain of effects and preconditions, some plan could be achieved to perform a more ellaborated task. The *logged_in* condition is, besides, the precondition of the following services:

- getAccounts
- getInvoices
- getBalance
- closeSession

4.2.3.2 Composite Process

In our Case Study we have not make use of the OWL-S compositeProcess as it's defined there. However we have developed a semi-automatic procedure to perform a composite process, as it has been described previously (see State Diagram Ontology). The processes that a composite process is made of can be atomic processes or other composite processes. One example of this situation could be the definition of a composite process which input will

be a user and the output will be a sequence of balances of his accounts. This process would use the atomic processes *getAccounts* and *getBalance*. This new process could be invoked, directly, by the agent if the instance of the *State Diagram Ontology* is defined with a new transaction whose IOPE's match with the new process defined.

The *State Diagram* instance is accessed by the agent to find the most suitable services to perform the task. If we change the state diagram (changing its behaviour), the services don't need to be changed because the selection and invocation of the most suitable service is made at run-time.

4.2.4 Grounding

A service grounding (``grounding'' for short) specifies the details of how an agent can access a service. Typically a grounding will specify a communication protocol, message formats, and other service-specific details such as port numbers used in contacting the service. In addition, the grounding must specify, for each abstract type specified in the *ServiceModel*, an unambiguous way of exchanging data elements of that type with the service (that is, the serialization techniques employed).

The grounding of a service specifies the details of how to access the service - details having mainly to do with protocol and message formats, serialization, transport, and addressing. A grounding can be thought of as a mapping from an abstract to a concrete specification of those service description elements that are required for interacting with the service - in particular, for our purposes, the inputs and outputs of atomic processes. Note that in OWL-S, both the *ServiceProfile* and the *ServiceModel* are thought of as abstract representations; only the *ServiceGrounding* deals with the concrete level of specification.

The Service Grounding is an instance of the *WsdlGrounding* class. This lists a number of *WsdlAtomicProcessGrounding's*, each of which will define an association between an OWL-S atomic process and a WSDL operation as follows. The *owlsProcess* identifies the atomic processes as defined in the OWL-S Process Model, and the *wsdlOperation* uniquely identifies the operation within a WSDL description by indicating both the operation name and its port type.

In the following example, we show an excerpt of the grounding describing GETseeSWS. In concrete terms we describe the grounding of the *getBalance* Service:

```
<grounding:WsdlGrounding rdf:ID="getseeSWSgetBalanceGrounding">
    <service:supportedBy rdf:resource="&getseeService;#getseeSWSgetBalanceService"/>
    <grounding:hasAtomicProcessGrounding rdf:resource="#getseeSWS_getbalance"/>
</grounding:WsdlGrounding>
<grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_getseeSWS_getbalance">
    <grounding:owlsProcess rdf:resource="&pm_file;#getseeSWS_getbalance"/>
    <grounding:wsdlOperation>
        <xsd:uriReference rdf:value="getseeSWSwsdl#getbalance"/>
    </grounding:wsdlOperation>
    <grounding:wsdlInputMessage>
        <xsd:uriReference rdf:value="getseeSWSwsdl#getbalanceRequest"/>
    </grounding:wsdlInputMessage>
    <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
        <grounding:WsdlMessageMap>
            <grounding:owlsParameter rdf:resource="&pm_file;#getseeSWS_getbalance_user_IN"/>
```

```
            <grounding:wsdlMessagePart>
                <xsd:uriReference rdf:value="getseeSWSwsdl#user"/>
            </grounding:wsdlMessagePart>
        </grounding:WsdlMessageMap>
        <grounding:WsdlMessageMap>
            <grounding:owlsParameter rdf:resource="&pm_file;#getseeSWS_getbalance_acount_IN"/>
            <grounding:wsdlMessagePart>
                <xsd:uriReference rdf:value="getseeSWSwsdl#acount"/>
            </grounding:wsdlMessagePart>
        </grounding:WsdlMessageMap>
    </grounding:wsdlInputMessageParts>
    <grounding:wsdlOutputMessage>
        <xsd:uriReference rdf:value="getseeSWSwsdl#getbalanceResponse"/>
    </grounding:wsdlOutputMessage>
    <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
        <grounding:WsdlMessageMap>
         <grounding:owlsParameter rdf:resource="&pm_file;#getseeSWS_getbalance_getbalanceReturn_OUT"/>
            <grounding:wsdlMessagePart>
                <xsd:uriReference rdf:value="getseeSWSwsdl#getbalanceReturn"/>
            </grounding:wsdlMessagePart>
        </grounding:WsdlMessageMap>
    </grounding:wsdlOutputMessageParts>
    <grounding:wsdlReference>
        <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
    </grounding:wsdlReference>
</grounding:WsdlAtomicProcessGrounding>
```

4.2.5 OWL-S / WSDL

A *WsdlAtomicProcessGrounding* instance refers to specific elements within the WSDL specification, using the following properties:

- *wsdlVersion*: A URI that indicates the version of WSDL in use.
- *wsdlDocument*: A URI of a WSDL document to which this grounding refers.
- *wsdlOperation*: The URI of the WSDL operation corresponding to the given atomic process.
- *wsdlInputMessage*: An object containing the URI of de domain ontology tha represents the men.
- *wsdlInputs*: An object containing a list of mapping pairs, one for each message part of the WSDL input message. Each such pair is represented using an instance of *WsdlInputMessageMap*. One element of the pair (expressed with the *wsdlMessagePart* property) identifies the message part, using a URI. The other element tells how to derive that message part from one or more inputs of the OWL-S atomic process. In the simplest cases this is done just by mentioning the URI of a particular input object (using the *owlsParameter* property). In all other cases, the *xsltTransformation* property gives an XSLT script that generates the message part from an instance of the atomic process. (The script may be given as a string embedded within the grounding instance, or as a URI.)

- *wsdlOutputMessage*: Similar to *wsdlInputMessage*, but for outputs.
- *wsdlOutputs*: Similar to *wsdlInputs*, but for outputs. In this case, we have a list of mapping pairs, one for each output of the OWL-S atomic process. Each such pair is represented using an instance of WsdlOutputMessageMap, and each pair contains a *owlsParameter* instance specifying the output. The other element of the pair can either be *wsdlMessagePart*, when there is a direct correpondence with a particular message part, or *xsltTransformation* for all other cases.

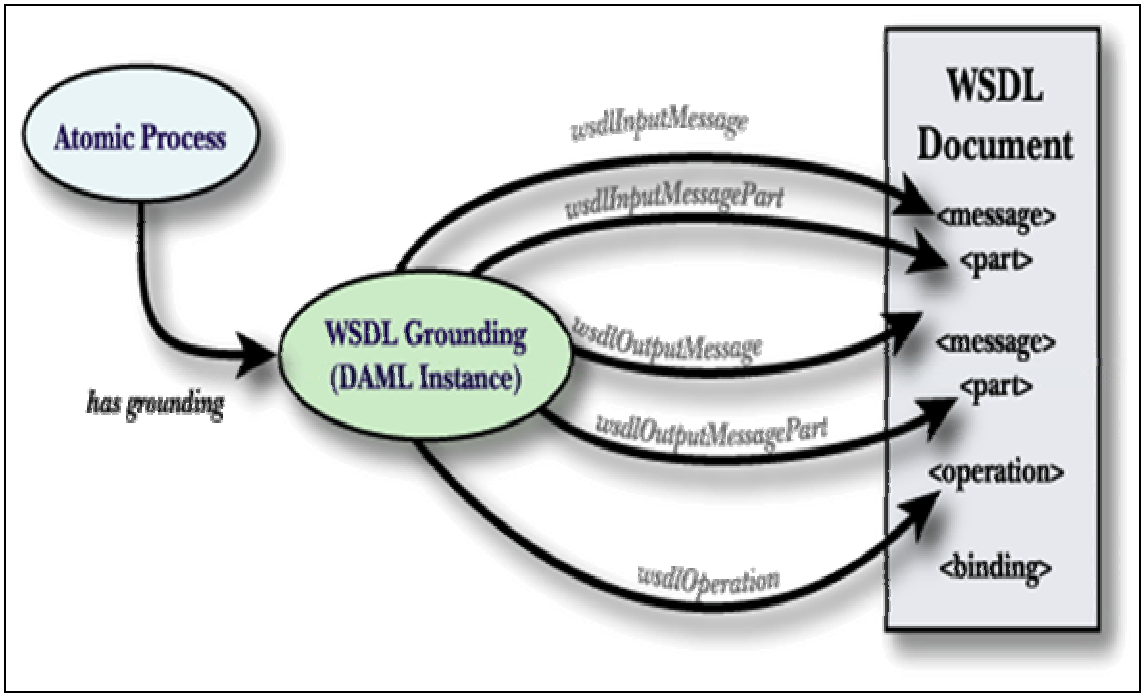


Figure 30 Correspondece between a WSDL grounding and a message

We can see in the following example, the way in which we have described the service in the WSDL file. In concrete, we refers to the *getBalance* Service:

```
<wsdl:message name="getbalanceRequest">
    <wsdl:part name="user" type="sentinel:login"/>
    <wsdl:part name="acount" type="sentinel:product_id"/>
</wsdl:message>
<wsdl:message name="getbalanceResponse">
    <wsdl:part name="getbalanceReturn" type="xsd:long"/>
</wsdl:message>
<wsdl:portType name="getseeSWS">
    <wsdl:operation name="getbalance" parameterOrder="user acount">
        <wsdl:input name="getbalanceRequest" message="intf:getbalanceRequest"/>
        <wsdl:output name="getbalanceResponse" message="intf:getbalanceResponse"/>
    </wsdl:operation>
</wsdl:portType>
```

```
<wsdl:binding name="getseeSWSSoapBinding" type="intf:getseeSWS">
    <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
    <wsdl:operation name="getbalance">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded"
             encodingStyle=http://schemas.xmlsoap.org/soap/encoding/  namespace="http://DefaultNamespace"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded"
             encodingStyle="http://schemas.xmlsoap.org/soap/encoding/" namespace="http://DefaultNamespace"/>
        </wsdl:output>
    </wsdl:operation>
</wsdl:binding>
<wsdl:service name="getseeSWSService">
    <wsdl:port name="getseeSWS" binding="intf:getseeSWSSoapBinding">
        <wsdlsoap:address location="http://users.isoco.net/~losada/swws/getinvoiceSWS/services/getseeSWS"/>
    </wsdl:port>
</wsdl:service>
```

OWL-S does not include an abstract construct for explicitly describing messages. Concrete messages, however, are specified explicitly in a grounding. The central function of an OWL-S grounding is to show how the (abstract) inputs and outputs of an atomic process are to be realized concretely as messages, which carry those inputs and outputs in some specific transmittable format.

The messages exchanged in our Case Study are modelled using different parts of the ProductDescriptions Ontology, the Notification Ontology and the Estimation Ontology. We annotate the messages using OWL-S joined with WSDL, allowing with this approach the matchmaking between the dataTypes of the Domain Ontologies and the *Service Grounding*.

```
<wsdl:types>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
        xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="Phone_number">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="sentinel:phn_number"/>
            </sequence>
        </complexType>
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
        xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="to">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="sentinel:emd_toEmail"/>
            </sequence>
        </complexType>
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
        xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="emd_subject">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="sentinel:emd_subject"/>
            </sequence>
        </complexType>
    </schema>
</wsdl:types>
```

5 Conclussions

With current tools and methodologies annotation of Semantic Web Services is a laborius and ungrateful task. One of the results of this deliverable is that our community (Semantic Web Services) has to provide those things before interesting results can come up.

This section aims in how work has been done and how could be improved. We consider lessons learned from the construction of domain ontologies and Semantic Web Services, specially for the expressivity of OWL-S.

To annotate the Semantic Web Services we have used the WSDL2OWL-S tool, http://www.daml.ri.cmu.edu/wsdl2owls/ . This tool generate a scaffolding for annotate part of the files (service, profile, process model, grounding) using a previous WSDL file describing the service. The files provided by the tool are useless if they are not completed with manual annotation. This manual annotation task is problematic. It's tough, requires a lot of time and there could be many inconsistences. There is no tool (in our understanding) for adding semantics, completely, to a Service.

Conditions are quite difficult to express in OWL-S using current approaches.

The OWL-S files have been validated using the following tools:

- RDF Validator: http://www.w3.org/RDF/Validator
- OWL Ontology Validator: http://phoebus.cs.man.ac.uk:9999/OWL/Validator
- OWL Validator: http://owl.bbn.com/validator

All the services files are OWL-full compliant, but the ontology files are OWL-DL compliant and have been created, in a semi-automated way using the Protégé editor: http://protege.stanford.edu.

OWL-S principles and paradigms have been followed, using these specifications:

- http://www.daml.org/services/owl-s/1.0/owl-s.html
- http://www.daml.org/services/owl-s/1.0/owl-s-wsdl.html
- http://www.daml.org/services/owl-s/1.0/examples.html

6 Technical Annex

In this section we exposed the files containing Ontologies and Services. We have built seven different Ontologies to demonstrate show up technical difficulties (Data Mediation, Discovery, Compensation) and six different Semantic Web Services (for the same purposes). Besides, we have used a hierarchyBank profile for discovery purposes, reusing it from the OWL-S web page.

The content of this section is as follows:

- Ontologies (We put all the OWL files containing the Ontologies built). One OWL file for Ontology.
    - ProductDescriptions Ontology. It describes the products and concepts included in the GETsee application. (see **¡Error! No se encuentra el origen de la referencia.**)
    - Notification Ontology. It models the way in that a User can be notified using different channels and Contact Informations. (see Notification Ontology)
    - EstimationParameter Ontology. It describes different manners to express arithmetical and statistic ways of estimates numerical values. (see Estimation Parameter Ontology)
    - Bank Ontology. It describes a reduced set of products and services offered by a bank. It simulates the behaviour of a Bank providing access to their Services using Semantic Web Services. (see Bank Ontology)
    - NotificationMail Ontology. It represents the concepts needed to express the sending of an e-mail. (see NotificationMail Ontology)
    - NotificationSMS Ontology. It represents the concepts needed to express the sending of a SMS. (see NotificationSMS Ontology)
    - State Diagram Ontology. It defines an abstract representation of a state diagram, representing the transitions as Semantic Web Services and the states as situations. (see StateDiagram Ontology)
    - Sentinel State Diagram Ontology. It model the particular behaviour desired for performing the sentinel task. (see SentinelStateDiagram Ontology)
- Services (For each service we describe its functionality using five different files: WSDL file, Service Description, Process Model, Service Profile and Service Grounding).
    - GETseeSWS Service. (see GETseeSWS Service)
    - Notification Service. (see Notification Service)
    - Estimation Service. (see EstimationParameter Service)
    - Bank Service. (see ServiceBank Service)
    - NotificationMail. (see NotificationMail Service)

- NotificationSMS. (see NotificationSMS Service)

6.1 Ontologies

6.1.1 ProductDescriptions Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-
schema#" xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl">
    <owl:Ontology rdf:about=""/>
    <owl:Class rdf:ID="InvestmentAccountsValues">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Details"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="InvestmentFunds">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Product"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="InvestmentAccounts">
        <rdfs:subClassOf rdf:resource="#Product"/>
    </owl:Class>
    <owl:Class rdf:ID="AccountLastTransactions">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="LastTransactions"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Currency"/>
    <owl:Class rdf:ID="invoiceDetails">
        <rdfs:subClassOf rdf:resource="#Details"/>
    </owl:Class>
    <owl:Class rdf:ID="SavingAccount">
        <rdfs:subClassOf rdf:resource="#Product"/>
    </owl:Class>
    <owl:Class rdf:ID="Loans">
        <rdfs:comment>Falta el tipo de interes al q pagamos la factura</rdfs:comment>
        <rdfs:subClassOf rdf:resource="#Product"/>
    </owl:Class>
    <owl:Class rdf:ID="Points">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Services"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="PhoneCurrentConsume">
        <rdfs:subClassOf rdf:resource="#Services"/>
    </owl:Class>
    <owl:Class rdf:ID="Invoices_payment">
        <rdfs:subClassOf rdf:resource="#Services"/>
    </owl:Class>
    <owl:Class rdf:ID="CreditCardLastTransactions">
        <rdfs:comment>Asociarle una tarjeta de credito</rdfs:comment>
        <rdfs:subClassOf rdf:resource="#LastTransactions"/>
    </owl:Class>
```

```
<owl:Class rdf:ID="PhoneCurrentConsumeDetails">
    <rdfs:subClassOf rdf:resource="#Details"/>
</owl:Class>
<owl:Class rdf:ID="User"/>
<owl:Class rdf:ID="CreditCards">
    <rdfs:subClassOf rdf:resource="#Services"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="ccb_ledgerBalanceCurrency">
    <rdfs:domain rdf:resource="#CreditCards"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="sao_date"/>
<owl:ObjectProperty rdf:ID="products">
    <rdfs:range rdf:resource="#Product"/>
    <owl:inverseOf>
        <owl:ObjectProperty rdf:about="#holder"/>
    </owl:inverseOf>
    <rdfs:domain rdf:resource="#User"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="iab_name">
    <rdfs:domain rdf:resource="#InvestmentFunds"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="cct_creditCard">
    <rdfs:range rdf:resource="#CreditCards"/>
    <owl:inverseOf>
        <owl:ObjectProperty rdf:about="#ccb_transactions"/>
    </owl:inverseOf>
    <rdfs:domain rdf:resource="#CreditCardLastTransactions"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="sa_transactions">
    <rdfs:range rdf:resource="#AccountLastTransactions"/>
    <rdfs:domain rdf:resource="#SavingAccount"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="in_details">
    <rdfs:range rdf:resource="#invoiceDetails"/>
    <rdfs:domain rdf:resource="#Invoices_payment"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="ccb_transactions">
    <rdfs:domain rdf:resource="#CreditCards"/>
    <owl:inverseOf rdf:resource="#cct_creditCard"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="pcc_details">
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
    <rdfs:range rdf:resource="#PhoneCurrentConsumeDetails"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="ccb_nextPayDate">
    <rdfs:domain rdf:resource="#CreditCards"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="values">
    <rdfs:range rdf:resource="#InvestmentAccountsValues"/>
    <rdfs:domain rdf:resource="#InvestmentFunds"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="holder">
    <rdfs:range rdf:resource="#User"/>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#Services"/>
                <owl:Class rdf:about="#Product"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
```

```
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#InverseFunctionalProperty"/>
    <owl:inverseOf rdf:resource="#products"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="services">
    <rdfs:domain rdf:resource="#User"/>
    <rdfs:range rdf:resource="#Services"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="contacts"/>
<owl:DatatypeProperty rdf:ID="Name">
    <rdfs:domain rdf:resource="#User"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="currency">
    <rdfs:domain rdf:resource="#Currency"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ccb_nextCloseDate">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#CreditCards"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="service_id">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#Services"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="d_amount">
    <rdfs:domain rdf:resource="#Details"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#integer"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="p_points">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
    <rdfs:domain rdf:resource="#Points"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="if_currency">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="login">
    <rdfs:domain rdf:resource="#User"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ccb_ledgerBalance">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#integer"/>
    <rdfs:domain rdf:resource="#CreditCards"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pcc_amount">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_nextPayDate">
    <rdfs:domain rdf:resource="#Loans"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
```

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</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_phone">
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="if_mktVal">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ccb_name">
    <rdfs:domain rdf:resource="#CreditCards"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pcc_fromDate">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="in_invoiceContractNumber">
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="it_concept">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#LastTransactions"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pcc_phone">
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="in_invoiceIndicative">
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="sab_accountOffice">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#SavingAccount"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="if_units">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ind_concept">
    <rdfs:domain rdf:resource="#invoiceDetails"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="product_id">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#Product"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_destinyPhone">
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="amount">
```

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        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
        <rdfs:domain>
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#LastTransactions"/>
                    <owl:Class rdf:about="#SavingAccount"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="l_startBalance">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
        <rdfs:domain rdf:resource="#Loans"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="l_accountNumber">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:domain rdf:resource="#Loans"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="sab_acountNumber">
        <rdfs:domain rdf:resource="#SavingAccount"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="l_currency">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:domain rdf:resource="#Loans"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="l_accountControlDigits">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#Loans"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="ind_detailConcept">
        <rdfs:domain rdf:resource="#invoiceDetails"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="in_invoiceDate">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#Invoices_payment"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="if_yieldMonths">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#InvestmentAccounts"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="l_nextPayCurrency">
        <rdfs:domain rdf:resource="#Loans"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="it_opDate">
        <rdfs:domain rdf:resource="#LastTransactions"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="password">
        <rdfs:domain rdf:resource="#User"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
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</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_startDate">
    <rdfs:domain rdf:resource="#Loans"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="interest_rate">
    <rdfs:domain rdf:resource="#Product"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#long"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_duration">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_nextPayAmount">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#integer"/>
    <rdfs:domain rdf:resource="#Loans"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="in_invoiceType">
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_type">
    <rdfs:domain rdf:resource="#Loans"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_accountOffice">
    <rdfs:domain rdf:resource="#Loans"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="in_invoiceNumber">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#Invoices_payment"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="alt_valueDate">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#AccountLastTransactions"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="l_accountEntity">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#Loans"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_date">
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_destiny">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pccd_type">
    <rdfs:domain rdf:resource="#PhoneCurrentConsumeDetails"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="if_yield">
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    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pcc_calls">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="if_unitPrice">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:SymmetricProperty rdf:ID="in_associatedAccount">
    <rdfs:range rdf:resource="#SavingAccount"/>
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <owl:inverseOf>
        <owl:InverseFunctionalProperty rdf:about="#sab_asociateInvoices"/>
    </owl:inverseOf>
</owl:SymmetricProperty>
<owl:FunctionalProperty rdf:ID="if_date">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="if_number">
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="number">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#InvestmentFunds"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="currency_name">
    <rdfs:range rdf:resource="#Currency"/>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#LastTransactions"/>
                <owl:Class rdf:about="#Details"/>
                <owl:Class rdf:about="#PhoneCurrentConsume"/>
                <owl:Class rdf:about="#SavingAccount"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="in_invoiceConsumeDate">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="in_invoiceCurrency">
    <rdfs:domain rdf:resource="#Invoices_payment"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="in_invoiceAmount">
    <rdfs:domain rdf:resource="#Invoices_payment"/>
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    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="l_balance">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
    <rdfs:domain rdf:resource="#Loans"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="if_buyVal">
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="pcc_toDate">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:domain rdf:resource="#PhoneCurrentConsume"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="if_name">
    <rdfs:domain rdf:resource="#InvestmentAccounts"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="sab_accountControlDigits">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:domain rdf:resource="#SavingAccount"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="l_startCurrency">
    <rdfs:domain rdf:resource="#Loans"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="sab_accountEntity">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#SavingAccount"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="sao_code">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="ind_invoiceNumber">
    <rdfs:domain rdf:resource="#invoiceDetails"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="p_url">
    <rdfs:domain rdf:resource="#Points"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="ccit_number">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#CreditCardLastTransactions"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="ccb_number">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#CreditCards"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
```

```
    <owl:FunctionalProperty rdf:ID="l_endDate">
        <rdfs:domain rdf:resource="#Loans"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="NIF">
        <rdfs:domain rdf:resource="#User"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:InverseFunctionalProperty rdf:ID="sab_asociateInvoices">
        <rdfs:range rdf:resource="#Invoices_payment"/>
        <owl:inverseOf rdf:resource="#in_associatedAccount"/>
        <rdfs:domain rdf:resource="#SavingAccount"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    </owl:InverseFunctionalProperty>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="ContactInfo"/>
        </rdf:rest>
        <rdf:first rdf:resource="#Phone"/>
    </rdf:Description>
    <rdf:Description>
        <rdf:first rdf:resource="#ContactInfo"/>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="Phone"/>
        </rdf:rest>
    </rdf:Description>
    <User rdf:ID="Silvestre_Losada">
        <Name>Silvestre</Name>
        <rdfs:comment>Persona par hacer una prueba</rdfs:comment>
        <password>añlsjdga</password>
        <NIF>7155842541</NIF>
        <login>silosalo</login>
    </User>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.2 Notification Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns="http://users.isoco.net/~slosada/swws/Estimation.owl#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/Estimation.owl">
    <owl:Ontology rdf:about=""/>
    <owl:Class rdf:ID="Notification">
        <rdfs:comment>Notification sent to the user by Notification Service.</rdfs:comment>
    </owl:Class>
    <owl:Class rdf:ID="EMailAddress">
        <owl:disjointWith>
            <owl:Class rdf:about="#Phone"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#PostalAddress"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#Fax"/>
        </owl:disjointWith>
```

```
        <rdfs:subClassOf>
            <owl:Class rdf:ID="ContactInfo"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="NotificationByEMail">
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
                <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf rdf:resource="#Notification"/>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByPhone"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByFax"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByPostalMail"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationBySMS"/>
        </owl:disjointWith>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:allValuesFrom rdf:resource="#EMailAddress"/>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="PostalAddress">
        <owl:disjointWith rdf:resource="#EMailAddress"/>
        <owl:disjointWith>
            <owl:Class rdf:about="#Phone"/>
        </owl:disjointWith>
        <rdfs:subClassOf rdf:resource="#ContactInfo"/>
        <owl:disjointWith>
            <owl:Class rdf:about="#Fax"/>
        </owl:disjointWith>
    </owl:Class>
    <owl:Class rdf:ID="NotificationBySMS">
        <rdfs:subClassOf rdf:resource="#Notification"/>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByPhone"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByFax"/>
        </owl:disjointWith>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
                <owl:allValuesFrom>
                    <owl:Class rdf:about="#Phone"/>
                </owl:allValuesFrom>
            </owl:Restriction>
```

```
    </rdfs:subClassOf>
    <owl:disjointWith rdf:resource="#NotificationByEMail"/>
    <owl:disjointWith>
        <owl:Class rdf:about="#NotificationByPostalMail"/>
    </owl:disjointWith>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="User"/>
<owl:Class rdf:ID="NotificationByPhone">
    <rdfs:subClassOf rdf:resource="#Notification"/>
    <owl:disjointWith rdf:resource="#NotificationBySMS"/>
    <owl:disjointWith rdf:resource="#NotificationByEMail"/>
    <owl:disjointWith>
        <owl:Class rdf:about="#NotificationByFax"/>
    </owl:disjointWith>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
        </owl:Restriction>
    </rdfs:subClassOf>
    <owl:disjointWith>
        <owl:Class rdf:about="#NotificationByPostalMail"/>
    </owl:disjointWith>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:allValuesFrom>
                <owl:Class rdf:about="#Phone"/>
            </owl:allValuesFrom>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Phone">
    <owl:disjointWith>
        <owl:Class rdf:about="#Fax"/>
    </owl:disjointWith>
    <owl:disjointWith rdf:resource="#EMailAddress"/>
    <rdfs:subClassOf rdf:resource="#ContactInfo"/>
    <owl:disjointWith rdf:resource="#PostalAddress"/>
</owl:Class>
<owl:Class rdf:ID="NotificationByFax">
    <owl:disjointWith rdf:resource="#NotificationByPhone"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:allValuesFrom>
                <owl:Class rdf:about="#Fax"/>
            </owl:allValuesFrom>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
            </owl:onProperty>
```

```
            </owl:Restriction>
        </rdfs:subClassOf>
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByPostalMail"/>
        </owl:disjointWith>
        <rdfs:subClassOf rdf:resource="#Notification"/>
        <owl:disjointWith rdf:resource="#NotificationBySMS"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
            </owl:Restriction>
        </rdfs:subClassOf>
        <owl:disjointWith rdf:resource="#NotificationByEMail"/>
    </owl:Class>
    <owl:Class rdf:ID="NotificationByPostalMail">
        <owl:disjointWith rdf:resource="#NotificationByEMail"/>
        <owl:disjointWith rdf:resource="#NotificationByPhone"/>
        <owl:disjointWith rdf:resource="#NotificationByFax"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
                <owl:allValuesFrom rdf:resource="#PostalAddress"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <owl:disjointWith rdf:resource="#NotificationBySMS"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:minCardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#int">1</owl:minCardinality>
                <owl:onProperty>
                    <owl:ObjectProperty rdf:about="#ntf_usesContactInfo"/>
                </owl:onProperty>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf rdf:resource="#Notification"/>
    </owl:Class>
    <owl:Class rdf:ID="Fax">
        <owl:disjointWith rdf:resource="#PostalAddress"/>
        <owl:disjointWith rdf:resource="#Phone"/>
        <rdfs:subClassOf rdf:resource="#ContactInfo"/>
        <owl:disjointWith rdf:resource="#EMailAddress"/>
    </owl:Class>
    <owl:ObjectProperty rdf:ID="pm_address">
        <rdfs:domain rdf:resource="#PostalAddress"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="ntf_usesContactInfo">
        <rdfs:domain rdf:resource="#Notification"/>
        <rdfs:range rdf:resource="#ContactInfo"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="contacts">
        <rdfs:domain rdf:resource="#User"/>
        <rdfs:range rdf:resource="#ContactInfo"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="holder">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#InverseFunctionalProperty"/>
        <rdfs:range rdf:resource="#User"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="ntf_userToBeNotified">
```

```
    <rdfs:domain rdf:resource="#Notification"/>
    <rdfs:range rdf:resource="#User"/>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="login">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#User"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pm_state">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#PostalAddress"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="emd_fromName">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="password">
    <rdfs:domain rdf:resource="#User"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_userToNotify">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_attachment">
    <rdfs:domain rdf:resource="#NotificationByEMail"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pm_city">
    <rdfs:domain rdf:resource="#PostalAddress"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NIF">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#User"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="phn_type">
    <rdfs:domain rdf:resource="#Phone"/>
    <rdfs:range>
        <owl:DataRange>
            <owl:oneOf rdf:parseType="Resource">
                <rdf:rest rdf:parseType="Resource">
                    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
                    <rdf:first>phone</rdf:first>
                </rdf:rest>
                <rdf:first>mobile</rdf:first>
            </owl:oneOf>
        </owl:DataRange>
    </rdfs:range>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_urgent">
    <rdfs:domain rdf:resource="#NotificationByPostalMail"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="emd_toName">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pm_zipCode">
    <rdfs:domain rdf:resource="#PostalAddress"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
```

```
<owl:DatatypeProperty rdf:ID="em_name">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="Name">
    <rdfs:domain rdf:resource="#User"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_cc">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#NotificationByEMail"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_receiptAcknowledgement">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#NotificationByEMail"/>
                <owl:Class rdf:about="#NotificationBySMS"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_date">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
    <rdfs:domain rdf:resource="#Notification"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="emd_cc">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="eml_new">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="pm_country">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#PostalAddress"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_body">
    <rdfs:domain rdf:resource="#Notification"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">notification body</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="eml_account">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#EMailAddress"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ntf_to">
    <rdfs:domain rdf:resource="#Notification"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="emd_fromMail">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="emd_attachCount">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="phn_number">
    <rdfs:domain>
```

```
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#Phone"/>
                    <owl:Class rdf:about="#Fax"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:FunctionalProperty rdf:ID="ntf_subject">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain>
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#NotificationByEMail"/>
                    <owl:Class rdf:about="#NotificationByPostalMail"/>
                    <owl:Class rdf:about="#NotificationByFax"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_subject">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_toEmail">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="eml_total">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_readed">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="ntf_from">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#Notification"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_date">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
    </owl:FunctionalProperty>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <owl:Class rdf:about="#Phone"/>
        </rdf:rest>
        <rdf:first rdf:resource="#ContactInfo"/>
    </rdf:Description>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <owl:Class rdf:about="#ContactInfo"/>
        </rdf:rest>
        <rdf:first rdf:resource="#Phone"/>
    </rdf:Description>
    <User rdf:ID="Silvestre_Losada">
        <rdfs:comment>Persona par hacer una prueba</rdfs:comment>
```

```
        <NIF>7155842541</NIF>
        <login>silosalo</login>
        <password>añlsjdga</password>
        <Name>Silvestre</Name>
    </User>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.3 Estimation Parameter Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns="http://users.isoco.net/~slosada/swws/Estimation.owl#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/Estimation.owl">
    <owl:Ontology rdf:about=""/>
    <owl:Class rdf:ID="average">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="EstimationParameter"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="balancedAverage">
        <rdfs:subClassOf rdf:resource="#EstimationParameter"/>
    </owl:Class>
    <owl:Class rdf:ID="termBalanceAverage"/>
    <owl:ObjectProperty rdf:ID="ProductDescriptionsOwl_Slot_0">
        <rdfs:domain rdf:resource="#balancedAverage"/>
        <rdfs:range rdf:resource="#termBalanceAverage"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="weight">
        <rdfs:domain rdf:resource="#termBalanceAverage"/>
    </owl:ObjectProperty>
    <owl:DatatypeProperty rdf:ID="term">
        <rdfs:domain>
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#average"/>
                    <owl:Class rdf:about="#termBalanceAverage"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="em_name">
        <rdfs:domain rdf:resource="#EstimationParameter"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <rdf:Description>
        <rdf:first rdf:resource="#Phone"/>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="ContactInfo"/>
        </rdf:rest>
    </rdf:Description>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="Phone"/>
        </rdf:rest>
        <rdf:first rdf:resource="#ContactInfo"/>
```

```
    </rdf:Description>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.4 Bank Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#" xmlns:rdf="http://www.w3.org/1999/02/22-
rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns="http://users.isoco.net/~slosada/swws/bank.owl#" xml:base="http://users.isoco.net/~slosada/swws/bank.owl">
    <owl:Ontology rdf:about="">
        <owl:imports rdf:resource="http://protege.stanford.edu/plugins/owl/protege"/>
    </owl:Ontology>
    <owl:Class rdf:ID="Loans">
        <rdfs:subClassOf>
            <owl:Class rdf:about="#Assets"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Customer"/>
    <owl:Class rdf:ID="Collection">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Service"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Assets">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Product"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="SOHO">
        <owl:disjointWith>
            <owl:Class rdf:about="#Person"/>
        </owl:disjointWith>
        <owl:disjointWith>
            <owl:Class rdf:about="#Company"/>
        </owl:disjointWith>
        <rdfs:subClassOf rdf:resource="#Customer"/>
    </owl:Class>
    <owl:Class rdf:ID="Branch">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Channel"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Staff">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Employee"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Person">
        <owl:disjointWith>
            <owl:Class rdf:about="#Company"/>
        </owl:disjointWith>
        <rdfs:subClassOf rdf:resource="#Customer"/>
        <owl:disjointWith rdf:resource="#SOHO"/>
    </owl:Class>
    <owl:Class rdf:ID="vBanking">
        <rdfs:subClassOf rdf:resource="#Channel"/>
    </owl:Class>
    <owl:Class rdf:ID="Invoices">
        <rdfs:subClassOf>
```

```
            <owl:Class rdf:about="#Payment"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Company">
        <owl:disjointWith rdf:resource="#Person"/>
        <owl:disjointWith rdf:resource="#SOHO"/>
        <rdfs:subClassOf rdf:resource="#Customer"/>
    </owl:Class>
    <owl:Class rdf:ID="Commercial">
        <rdfs:subClassOf rdf:resource="#Employee"/>
    </owl:Class>
    <owl:Class rdf:ID="ProductRateApplication"/>
    <owl:Class rdf:ID="AddedValue">
        <rdfs:subClassOf rdf:resource="#Service"/>
    </owl:Class>
    <owl:Class rdf:ID="SME">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="Department"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Individuals">
        <rdfs:subClassOf rdf:resource="#Department"/>
    </owl:Class>
    <owl:Class rdf:ID="Payment">
        <rdfs:subClassOf rdf:resource="#Service"/>
    </owl:Class>
    <owl:Class rdf:ID="Corporative">
        <rdfs:subClassOf rdf:resource="#Department"/>
    </owl:Class>
    <owl:Class rdf:ID="InvestmentAccounts">
        <rdfs:subClassOf rdf:resource="#Assets"/>
    </owl:Class>
    <owl:Class rdf:ID="Liability">
        <rdfs:subClassOf rdf:resource="#Product"/>
    </owl:Class>
    <owl:Class rdf:ID="Administrative">
        <rdfs:subClassOf rdf:resource="#Employee"/>
    </owl:Class>
    <owl:Class rdf:ID="SavingAccount">
        <rdfs:subClassOf rdf:resource="#Assets"/>
    </owl:Class>
    <owl:Class rdf:ID="ServicesContractedByCustomerInChannel"/>
    <owl:Class rdf:ID="InvestmentFunds">
        <rdfs:subClassOf rdf:resource="#Assets"/>
    </owl:Class>
    <owl:ObjectProperty rdf:ID="signalDateContract">
        <rdfs:domain rdf:resource="#Product"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="password">
        <rdfs:domain rdf:resource="#Customer"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="NIF">
        <rdfs:domain>
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#SOHO"/>
                    <owl:Class rdf:about="#Person"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
    </owl:ObjectProperty>
```

```
    <owl:ObjectProperty rdf:ID="payments">
        <rdfs:domain rdf:resource="#SavingAccount"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="interestRateType">
        <rdfs:domain rdf:resource="#Product"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="customer">
        <rdfs:domain rdf:resource="#ServicesContractedByCustomerInChannel"/>
        <rdfs:range rdf:resource="#Customer"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="service">
        <rdfs:range rdf:resource="#Service"/>
        <rdfs:domain rdf:resource="#ServicesContractedByCustomerInChannel"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="CIF">
        <rdfs:domain rdf:resource="#Company"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="channel">
        <rdfs:domain rdf:resource="#ServicesContractedByCustomerInChannel"/>
        <rdfs:range rdf:resource="#Channel"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="titularity">
        <rdfs:range rdf:resource="#Product"/>
        <rdfs:domain rdf:resource="#Customer"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#SymmetricProperty"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="interestRateValue">
        <rdfs:domain rdf:resource="#Product"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:ObjectProperty>
    <owl:DatatypeProperty rdf:ID="login">
        <rdfs:domain rdf:resource="#Customer"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="name">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain>
            <owl:Class>
                <owl:unionOf rdf:parseType="Collection">
                    <owl:Class rdf:about="#Customer"/>
                    <owl:Class rdf:about="#Product"/>
                </owl:unionOf>
            </owl:Class>
        </rdfs:domain>
    </owl:DatatypeProperty>
    <owl:FunctionalProperty rdf:ID="expirationDate">
        <rdfs:domain rdf:resource="#Product"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    </owl:FunctionalProperty>
    <owl:InverseFunctionalProperty rdf:ID="typeOfRate">
        <rdfs:domain rdf:resource="#ProductRateApplication"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    </owl:InverseFunctionalProperty>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.5 NotificationMail Ontology

```
<?xml version="1.0"?>
```

```
<rdf:RDF xmlns="http://users.isoco.net/~slosada/swws/NotificationMail.owl#" xmlns:rdf="http://www.w3.org/1999/02/22-
rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/NotificationMail.owl">
    <owl:Ontology rdf:about=""/>
    <owl:Class rdf:ID="NotificationByEMail">
        <owl:disjointWith>
            <owl:Class rdf:about="#NotificationByFax"/>
        </owl:disjointWith>
        <rdfs:subClassOf>
            <owl:Class rdf:about="#Notification"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="Notification">
        <rdfs:comment>Notification sent to the user by Notification Service.</rdfs:comment>
    </owl:Class>
    <owl:Class rdf:ID="NotificationByFax">
        <owl:disjointWith rdf:resource="#NotificationByEMail"/>
        <rdfs:subClassOf rdf:resource="#Notification"/>
    </owl:Class>
    <owl:ObjectProperty rdf:ID="ntf_usesContactInfo"/>
    <owl:ObjectProperty rdf:ID="ntf_userToBeNotified"/>
    <owl:DatatypeProperty rdf:ID="emd_toName">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="emd_cc">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="eml_new">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_subject">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#NotificationByEMail"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="emd_toEmail">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="emd_fromMail">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_date">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
        <rdfs:domain rdf:resource="#Notification"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="emd_attachCount">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="emd_fromName">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_cc">
        <rdfs:domain rdf:resource="#NotificationByEMail"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_attachment">
        <rdfs:domain rdf:resource="#NotificationByEMail"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_to">
```

```
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#Notification"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="ntf_userToNotify">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="notification_body">
        <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">notification body</rdfs:comment>
        <rdfs:domain rdf:resource="#Notification"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:FunctionalProperty rdf:ID="emd_readed">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="notification_from">
        <rdfs:domain rdf:resource="#Notification"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="eml_total">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_date">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="emd_subject">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="eml_account">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </owl:FunctionalProperty>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="ContactInfo"/>
        </rdf:rest>
        <rdf:first rdf:resource="#Phone"/>
    </rdf:Description>
    <rdf:Description>
        <rdf:first rdf:resource="#ContactInfo"/>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="Phone"/>
        </rdf:rest>
    </rdf:Description>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.6 NotificationSMS Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#" xmlns:rdf="http://www.w3.org/1999/02/22-
rdf-syntax-ns#" xmlns="http://users.isoco.net/~slosada/swws/NotificationSMS.owl#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/NotificationSMS.owl">
```

```
<owl:Ontology rdf:about=""/>
<owl:Class rdf:ID="message"/>
<owl:Class rdf:ID="NotificationByPhone">
    <rdfs:subClassOf>
        <owl:Class rdf:about="#Notification"/>
    </rdfs:subClassOf>
    <owl:disjointWith>
        <owl:Class rdf:about="#NotificationBySMS"/>
    </owl:disjointWith>
</owl:Class>
<owl:Class rdf:ID="NotificationBySMS">
    <owl:disjointWith rdf:resource="#NotificationByPhone"/>
    <rdfs:subClassOf>
        <owl:Class rdf:about="#Notification"/>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Notification">
    <rdfs:comment>Notification sent to the user by Notification Service.</rdfs:comment>
</owl:Class>
<owl:ObjectProperty rdf:ID="ntf_userToBeNotified"/>
<owl:ObjectProperty rdf:ID="msg">
    <rdfs:range>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
                <owl:Class rdf:about="#message"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:range>
    <rdfs:domain rdf:resource="#Notification"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="ntf_usesContactInfo">
    <rdfs:range rdf:resource="#message"/>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="ntf_to">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="phn_number">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#NotificationByPhone"/>
                <owl:Class rdf:about="#Notification"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="phn_type">
    <rdfs:range>
        <owl:DataRange>
            <owl:oneOf rdf:parseType="Resource">
                <rdf:first>mobile</rdf:first>
                <rdf:rest rdf:parseType="Resource">
                    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
                    <rdf:first>phone</rdf:first>
                </rdf:rest>
            </owl:oneOf>
        </owl:DataRange>
    </rdfs:range>
</owl:DatatypeProperty>
```

```
    <owl:DatatypeProperty rdf:ID="msg_body">
        <rdfs:domain rdf:resource="#message"/>
        <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">notification body</rdfs:comment>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="msg_date">
        <rdfs:domain rdf:resource="#message"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="em_name">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="ntf_userToNotify">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    </owl:DatatypeProperty>
    <owl:FunctionalProperty rdf:ID="ntf_receiptAcknowledgement">
        <rdfs:domain rdf:resource="#NotificationBySMS"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="msg_from">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#message"/>
    </owl:FunctionalProperty>
    <rdf:Description>
        <rdf:rest rdf:parseType="Collection">
            <owl:Class rdf:about="#message"/>
        </rdf:rest>
        <rdf:first rdf:resource="#Phone"/>
    </rdf:Description>
    <rdf:Description>
        <rdf:first rdf:resource="#message"/>
        <rdf:rest rdf:parseType="Collection">
            <rdf:Description rdf:ID="Phone"/>
        </rdf:rest>
    </rdf:Description>
</rdf:RDF>
<!-- Created with Protege (with OWL Plugin 1.0, Build 72)  http://protege.stanford.edu -->
```

6.1.7 StateDiagram Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:process="http://www.daml.org/services/owl-s/1.0/Process.owl#"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns="http://users.isoco.net/~slosada/swws/statediagram.owl#"
xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/statediagram.owl">
    <owl:Ontology rdf:about="">
        <rdfs:comment>State Diagram Ontology.</rdfs:comment>
        <owl:imports rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl"/>
    </owl:Ontology>
    <owl:Class rdf:ID="inputs"/>
    <owl:Class rdf:ID="start">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="state"/>
        </rdfs:subClassOf>
    </owl:Class>
```

```
<owl:Class rdf:ID="transition"/>
<owl:Class rdf:ID="condition">
    <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Condition"/>
    <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Effect"/>
</owl:Class>
<owl:Class rdf:ID="output"/>
<owl:Class rdf:ID="end">
    <rdfs:subClassOf rdf:resource="#state"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="state_start">
    <rdfs:domain rdf:resource="#transition"/>
    <rdfs:range rdf:resource="#state"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:DataProperty rdf:ID="transition_input">
    <rdfs:domain rdf:resource="#transition"/>
</owl:DataProperty>
<owl:ObjectProperty rdf:ID="transition_input">
    <rdfs:domain rdf:resource="#transition"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="input_id">
    <rdfs:domain rdf:resource="#inputs"/>
</owl:ObjectProperty>
<owl:DataProperty rdf:ID="transition_output">
    <rdfs:domain rdf:resource="#transition"/>
</owl:DataProperty>
<owl:ObjectProperty rdf:ID="transition_output">
    <rdfs:domain rdf:resource="#transition"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="output_reference">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#output"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="condition_reference">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="#condition"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="state_conditions">
    <rdfs:domain rdf:resource="#state"/>
    <rdfs:range rdf:resource="#condition"/>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="transition_id">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#transition"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="output_id">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#output"/>
</owl:DatatypeProperty>
<owl:FunctionalProperty rdf:ID="state_id">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain rdf:resource="#state"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="state_end">
    <rdfs:domain rdf:resource="#transition"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdfs:range rdf:resource="#state"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="input_reference">
    <rdfs:domain rdf:resource="#inputs"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
```

```
    </owl:FunctionalProperty>
    <owl:FunctionalProperty rdf:ID="condition_id">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#condition"/>
    </owl:FunctionalProperty>
</rdf:RDF>
```

6.1.8 SentinelStateDiagram Ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:p1="http://www.isi.edu/~pan/damltime/timezone-ont.owl#"
xmlns:S_Estimation="http://users.isoco.net/~slosada/swws/Estimation.owl#"
xmlns:GETsee="http://users.isoco.net/~slosada/swws//ProductDescriptiosOwl.owl#"
xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-
ns#" xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
xmlns:p2="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#" xmlns:time-
entry="http://www.isi.edu/~pan/damltime/time-entry.owl#" xmlns:process="http://www.daml.org/services/owl-
s/1.0/Process.owl#" xmlns:S_Notification="http://users.isoco.net/~slosada/swws/Notification.owl#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns="http://users.isoco.net/~slosada/swws/StatediagramSentinel.owl#"
xmlns:service="http://www.daml.org/services/owl-s/1.0/Service.owl#"
xmlns:daml="http://www.daml.org/2001/03/daml+oil#"
xml:base="http://users.isoco.net/~slosada/swws/StatediagramSentinel.owl">
    <owl:Ontology rdf:about="">
        <rdfs:comment>State Diagram Ontology.</rdfs:comment>
        <owl:imports rdf:resource="http://users.isoco.net/~slosada/swws/Notification.owl"/>
        <owl:imports rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl"/>
        <owl:imports rdf:resource="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl"/>
        <owl:imports rdf:resource="http://users.isoco.net/~slosada/swws/Estimation.owl"/>
    </owl:Ontology>
    <owl:Class rdf:ID="inputs"/>
    <owl:Class rdf:ID="stateEnd">
        <rdfs:subClassOf>
            <owl:Class rdf:ID="state"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="input_boolean">
        <rdfs:subClassOf rdf:resource="#inputs"/>
    </owl:Class>
    <owl:Class rdf:ID="output_InvoicesPayments">
        <rdfs:subClassOf
rdf:resource="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#Invoices_payment"/>
        <rdfs:subClassOf>
            <owl:Class rdf:ID="output"/>
        </rdfs:subClassOf>
    </owl:Class>
    <owl:Class rdf:ID="input_userNotification">
        <rdfs:subClassOf rdf:resource="#inputs"/>
        <rdfs:subClassOf rdf:resource="http://users.isoco.net/~slosada/swws/Notification.owl#User"/>
    </owl:Class>
    <owl:Class rdf:ID="input_notification">
        <rdfs:subClassOf rdf:resource="#inputs"/>
        <rdfs:subClassOf rdf:resource="http://users.isoco.net/~slosada/swws/Notification.owl#Notification"/>
    </owl:Class>
    <owl:Class rdf:ID="condition">
        <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Condition"/>
        <rdfs:subClassOf rdf:resource="http://www.daml.org/services/owl-s/1.0/Process.owl#Effect"/>
    </owl:Class>
```

```
    <owl:Class rdf:ID="transition"/>
    <owl:Class rdf:ID="input_output_savingAccounts">
        <rdfs:subClassOf rdf:resource="#inputs"/>
        <rdfs:subClassOf
rdf:resource="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#SavingAccount"/>
        <rdfs:subClassOf rdf:resource="#output"/>
    </owl:Class>
    <owl:Class rdf:ID="stateStart">
        <rdfs:subClassOf rdf:resource="#state"/>
    </owl:Class>
    <owl:Class rdf:ID="output_boolean">
        <rdfs:subClassOf rdf:resource="#output"/>
    </owl:Class>
    <owl:Class rdf:ID="input_Average">
        <rdfs:subClassOf rdf:resource="#inputs"/>
        <rdfs:subClassOf rdf:resource="http://users.isoco.net/~slosada/swws/Estimation.owl#average"/>
    </owl:Class>
    <owl:Class rdf:ID="input_user">
        <rdfs:subClassOf rdf:resource="#inputs"/>
        <rdfs:subClassOf rdf:resource="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#User"/>
    </owl:Class>
    <owl:ObjectProperty rdf:ID="state_start">
        <rdfs:domain rdf:resource="#transition"/>
        <rdfs:range rdf:resource="#state"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="transition_input">
 </owl:ObjectProperty>
    <owl:DataProperty rdf:ID="transition_input">
 </owl:DataProperty>
    <owl:ObjectProperty rdf:ID="state_end">
        <rdfs:domain rdf:resource="#transition"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:range rdf:resource="#state"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="input_id">
        <rdfs:domain rdf:resource="#inputs"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="transition_output">
        <rdfs:domain rdf:resource="#transition"/>
        <rdfs:range rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="output_reference">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <rdfs:domain rdf:resource="#output"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="condition_reference">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="state_conditions">
        <rdfs:domain rdf:resource="#state"/>
        <rdfs:range rdf:resource="#condition"/>
    </owl:ObjectProperty>
    <owl:DatatypeProperty rdf:ID="transition_id">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#transition"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    </owl:DatatypeProperty>
    <owl:DatatypeProperty rdf:ID="output_id">
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
        <rdfs:domain rdf:resource="#output"/>
    </owl:DatatypeProperty>
```

```
<owl:FunctionalProperty rdf:ID="state_id">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="input_reference">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="condition_id">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<state rdf:ID="Compared"/>
<transition rdf:ID="KB_044630_Individual_86">
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <state_start>
        <state rdf:ID="Looged">
            <state_conditions>
                <condition rdf:ID="logged_in"/>
            </state_conditions>
        </state>
    </state_start>
    <transition_id>GETseeSWScloseSession</transition_id>
    <state_end>
        <stateEnd rdf:ID="endState"/>
    </state_end>
</transition>
<transition rdf:ID="KB_044630_Individual_87">
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <state_end rdf:resource="#endState"/>
    <transition_id>GETseeSWScloseSession</transition_id>
    <state_start>
        <state rdf:ID="AccountsLoaded">
            <state_conditions rdf:resource="#logged_in"/>
        </state>
    </state_start>
</transition>
<transition rdf:ID="KB_044630_Individual_94">
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="#output_InvoicesPayments"/>
    <transition_id>GETseeSWSgetinvoices</transition_id>
    <state_end>
        <state rdf:ID="InvoicesLoaded">
            <state_conditions rdf:resource="#logged_in"/>
        </state>
    </state_end>
    <transition_input rdf:resource="#input_output_savingAccounts"/>
    <state_start>
        <state rdf:ID="Estimated">
            <state_conditions rdf:resource="#logged_in"/>
        </state>
    </state_start>
</transition>
<transition rdf:ID="KB_044630_Individual_93">
    <state_start rdf:resource="#Compared"/>
    <transition_input rdf:resource="#input_output_savingAccounts"/>
    <transition_input rdf:resource="#input_user"/>
    <transition_id>GETseeSWSgetinvoices</transition_id>
    <trnasition_output rdf:resource="#output_InvoicesPayments"/>
    <state_end rdf:resource="#InvoicesLoaded"/>
</transition>
```

```
<state rdf:ID="Estimated">
    <state_conditions rdf:resource="#logged_in"/>
</state>
<transition rdf:ID="KB_044630_Individual_95">
    <transition_id>Compare</transition_id>
    <transition_input rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
    <transition_input rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
    <state_start rdf:resource="#Estimated"/>
    <state_end rdf:resource="#Compared"/>
</transition>
<transition rdf:ID="KB_044630_Individual_96">
    <state_start rdf:resource="#Estimated"/>
    <transition_input rdf:resource="#input_Average"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
    <state_end rdf:resource="#InvoicesLoaded"/>
    <transition_id>estimationAverageProfile</transition_id>
</transition>
<transition rdf:ID="KB_044630_Individual_85">
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <transition_id>GETseeSWScloseSession</transition_id>
    <state_end rdf:resource="#endState"/>
    <state_start rdf:resource="#Notified"/>
</transition>
<transition rdf:ID="KB_044630_Individual_89">
    <transition_id>GETseeSWScloseSession</transition_id>
    <state_start rdf:resource="#Estimated"/>
    <state_end rdf:resource="#endState"/>
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
</transition>
<transition rdf:ID="KB_044630_Individual_97">
    <transition_id>notificationSendProfile</transition_id>
    <transition_input rdf:resource="#input_userNotification"/>
    <state_start rdf:resource="#Compared"/>
    <state_end rdf:resource="#Notified"/>
</transition>
<rdf:Description rdf:about="http://www.isi.edu/~pan/damltime/time-entry.owl#minutes">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</rdf:Description>
<transition rdf:ID="KB_044630_Individual_91">
    <state_end rdf:resource="#AccountsLoaded"/>
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="#input_output_savingAccounts"/>
    <transition_id>GETseeSWSgetAccounts</transition_id>
    <state_start rdf:resource="#Logged"/>
</transition>
<transition rdf:ID="KB_044630_Individual_84">
    <state_end rdf:resource="#Logged"/>
    <state_start>
        <stateStart rdf:ID="initState"/>
    </state_start>
    <transition_id>GETseeSWSlogin</transition_id>
    <transition_input rdf:resource="#input_user"/>
    <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
</transition>
<transition rdf:ID="KB_044630_Individual_92">
    <transition_input rdf:resource="#input_output_savingAccounts"/>
    <transition_input rdf:resource="#input_user"/>
    <state_start rdf:resource="#AccountsLoaded"/>
    <transition_id>GETseeSWSgetinvoices</transition_id>
```

```
        <trnasition_output rdf:resource="#output_InvoicesPayments"/>
        <state_end rdf:resource="#InvoicesLoaded"/>
    </transition>
    <transition rdf:ID="KB_044630_Individual_90">
        <transition_id>GETseeSWScloseSession</transition_id>
        <state_end rdf:resource="#endState"/>
        <transition_input rdf:resource="#input_user"/>
        <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
        <state_start rdf:resource="#Compared"/>
    </transition>
    <transition rdf:ID="KB_044630_Individual_88">
        <state_start rdf:resource="#InvoicesLoaded"/>
        <transition_input rdf:resource="#input_user"/>
        <trnasition_output rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
        <state_end rdf:resource="#endState"/>
        <transition_id>GETseeSWScloseSession</transition_id>
    </transition>
</rdf:RDF>
```

6.2 Services

6.2.1 GETseeSWS Service

6.2.1.1 GETseeSWS WSDL

```
<wsdl:definitions xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:GETseeDomain="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
targetNamespace="http://users.isoco.net/~slosada/swws/">
    <wsdl:types>
        <schema
        targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="SavingAccount">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item"
        type="GETseeDomain:SavingAccount"/>
                </sequence>
            </complexType>
        </schema>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="User">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item"
        type="GETseeDomain:User"/>
                </sequence>
            </complexType>
        </schema>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="Invoices_payment">
```

```
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item"
    type="GETseeDomain:Invoices_payment"/>
            </sequence>
        </complexType>
    </schema>
</wsdl:types>
<wsdl:message name="getInvoicesRequest">
    <wsdl:part name="user" type="GETseeDomain:User"/>
    <wsdl:part name="acount" type="GETseeDomain:SavingAccount"/>
</wsdl:message>
<wsdl:message name="closeSesionResponse">
    <wsdl:part name="closeSesionReturn" type="xsd:boolean"/>
</wsdl:message>
<wsdl:message name="loginRequest">
    <wsdl:part name="User" type="GETseeDomain:User"/>
</wsdl:message>
<wsdl:message name="getbalanceRequest">
    <wsdl:part name="user" type="GETseeDomain:User"/>
    <wsdl:part name="acount" type="GETseeDomain:SavingAccount"/>
</wsdl:message>
<wsdl:message name="getInvoicesResponse">
    <wsdl:part name="getInvoicesReturn" type="GETseeDomain:Invoices_payment"/>
</wsdl:message>
<wsdl:message name="getAcountsResponse">
    <wsdl:part name="getAcountsReturn" type="GETseeDomain:SavingAccount"/>
</wsdl:message>
<wsdl:message name="getbalanceResponse">
    <wsdl:part name="getbalanceReturn" type="xsd:long"/>
</wsdl:message>
<wsdl:message name="getAcountsRequest">
    <wsdl:part name="user" type="GETseeDomain:User"/>
</wsdl:message>
<wsdl:message name="loginResponse">
    <wsdl:part name="loginReturn" type="xsd:boolean"/>
</wsdl:message>
<wsdl:message name="closeSesionRequest">
    <wsdl:part name="user" type="GETseeDomain:User"/>
</wsdl:message>
<wsdl:portType name="GETseeSWS">
    <wsdl:operation name="login" parameterOrder="user password">
        <wsdl:input name="loginRequest" message="intf:loginRequest"/>
        <wsdl:output name="loginResponse" message="intf:loginResponse"/>
    </wsdl:operation>
    <wsdl:operation name="closeSesion" parameterOrder="user">
        <wsdl:input name="closeSesionRequest" message="intf:closeSesionRequest"/>
        <wsdl:output name="closeSesionResponse" message="intf:closeSesionResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getAcounts" parameterOrder="user">
        <wsdl:input name="getAcountsRequest" message="intf:getAcountsRequest"/>
        <wsdl:output name="getAcountsResponse" message="intf:getAcountsResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getInvoices" parameterOrder="user acount">
        <wsdl:input name="getInvoicesRequest" message="intf:getInvoicesRequest"/>
        <wsdl:output name="getInvoicesResponse" message="intf:getInvoicesResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getbalance" parameterOrder="user acount">
        <wsdl:input name="getbalanceRequest" message="intf:getbalanceRequest"/>
        <wsdl:output name="getbalanceResponse" message="intf:getbalanceResponse"/>
    </wsdl:operation>
</wsdl:portType>
<wsdl:binding name="GETseeSWSSoapBinding" type="intf:GETseeSWS">
```

```
    <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
    <wsdl:operation name="login">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="closeSesion">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="getAcounts">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="getInvoices">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="getbalance">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
</wsdl:binding>
<wsdl:service name="GETseeSWSService">
    <wsdl:port name="GETseeSWS" binding="intf:GETseeSWSSoapBinding">
        <wsdlsoap:address location="http://localhost:8080/getinvoiceSWS/services/GETseeSWS"/>
    </wsdl:port>
</wsdl:service>
```

```
</wsdl:definitions>
```

6.2.1.2 GETseeSWS Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/GETseeSWSProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/GETseeSWSServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/GETseeSWSGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:my_process="&my_process;#" xmlns:my_profile="&my_profile;#" xmlns:my_grounding="&my_grounding;#">
    <owl:Ontology about="">
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
    </owl:Ontology>
    <service:Service rdf:ID="GETseeSWSloginService">
        <service:presents rdf:resource="&my_profile;#GETseeSWSlogin"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWSloginProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWSloginGrounding"/>
    </service:Service>
    <service:Service rdf:ID="GETseeSWScloseSessionService">
        <service:presents rdf:resource="&my_profile;#GETseeSWSCloseSession"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWScloseSessionProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWScloseSessionGrounding"/>
    </service:Service>
    <service:Service rdf:ID="GETseeSWScloseSessionService">
        <service:presents rdf:resource="&my_profile;#GETseeSWScloseSession"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWScloseSessionProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWScloseSessionGrounding"/>
    </service:Service>
    <service:Service rdf:ID="GETseeSWSgetAccountsService">
        <service:presents rdf:resource="&my_profile;#GETseeSWSgetAccounts"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWSgetAccountsProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWSgetAccountsGrounding"/>
    </service:Service>
    <service:Service rdf:ID="GETseeSWSgetBalanceService">
        <service:presents rdf:resource="&my_profile;#GETseeSWSgetBalance"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWSgetBalanceProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWSgetBalanceGrounding"/>
    </service:Service>
    <service:Service rdf:ID="GETseeSWSgetInvoicesService">
        <service:presents rdf:resource="&my_profile;#GETseeSWSgetInvoices"/>
        <service:describedBy rdf:resource="&my_process;#GETseeSWSgetInvoicesProcess"/>
        <service:supports rdf:resource="&my_grounding;#GETseeSWSgetInvoicesGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.1.3 GETseeSWS Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY GETseeDomain "http://users.isoco.net/~slosada/swws/ProductsDescriptions.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:GETseeDomain="&GETseeDomain;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 $</owl:versionInfo>
        <rdfs:comment>  </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&GETseeDomain;"/>
    </owl:Ontology>
    <owl:Class rdf:ID="conditionEffect">
        <rdfs:subClassOf rdf:resource="&process;#Condition"/>
        <rdfs:subClassOf rdf:resource="&process;#Effect"/>
    </owl:Class>
    <conditionEffect rdf:ID="logged_in"/>
    <process:ProcessModel rdf:ID="GETseeSWSloginProcess">
        <process:hasProcess rdf:resource="#GETseeSWS_login"/>
        <service:describes rdf:resource="&service;#GETseeSWSloginService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="GETseeSWScloseSessionProcess">
        <process:hasProcess rdf:resource="#GETseeSWS_closeSesion"/>
        <service:describes rdf:resource="&service;#GETseeSWScloseSessionService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="GETseeSWSgetAccountsProcess">
        <process:hasProcess rdf:resource="#GETseeSWS_getAcounts"/>
        <service:describes rdf:resource="&service;#GETseeSWSgetAccountsService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="GETseeSWSgetInvoicesProcess">
        <process:hasProcess rdf:resource="#GETseeSWS_getInvoices"/>
        <service:describes rdf:resource="&service;#GETseeSWSgetInvoicesService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="GETseeSWSgetBalanceProcess">
        <process:hasProcess rdf:resource="#GETseeSWS_getBalance"/>
        <service:describes rdf:resource="&service;#GETseeSWSgetBalanceService"/>
    </process:ProcessModel>
    <!--  composite processes if needed-->
    <!--Definitions for Atomic Process : GETseeSWS_login-->
    <!--Inputs-->
    <process:Input rdf:ID="GETseeSWS_login_user_IN">
        <process:parameterName>GETseeSWS_login_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#User"/>
    </process:Input>
    <process:Effect rdf:ID="logged_in">
        <process:ConditionalEffect>
            <process:ceCondition rdf:resource="#message_flag_error_false"/>
            <process:ceEffect rdf:resource="#logged_in"/>
```

```
        </process:ConditionalEffect>
    </process:Effect>
    <!--Outputs-->
    <process:Output rdf:ID="GETseeSWS_login_loginReturn_OUT">
        <process:parameterName>GETseeSWS_login_loginReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#boolean"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="GETseeSWS_login">
        <process:hasEffect rdf:ID="logged_in"/>
        <process:hasInput rdf:resource="GETseeSWS_login_password_IN"/>
        <process:hasInput rdf:resource="GETseeSWS_login_login_IN"/>
        <process:hasOutput rdf:resource="GETseeSWS_login_loginReturn_OUT"/>
    </process:AtomicProcess>
    <process:Input rdf:ID="GETseeSWS_closeSesion_user_IN">
        <process:parameterName>GETseeSWS_closeSesion_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#User"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="GETseeSWS_closeSesion_closeSesionReturn_OUT">
        <process:parameterName>GETseeSWS_closeSesion_closeSesionReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#boolean"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="GETseeSWS_closeSesion">
        <process:hasPrecondition rdf:resource="#logged_in"/>
        <process:hasInput rdf:resource="GETseeSWS_closeSesion_user_IN"/>
        <process:hasOutput rdf:resource="GETseeSWS_closeSesion_closeSesionReturn_OUT"/>
    </process:AtomicProcess>
    <!--Definitions for Atomic Process : GETseeSWS_getAcounts-->
    <!--Inputs-->
    <process:Input rdf:ID="GETseeSWS_getAcounts_user_IN">
        <process:parameterName>GETseeSWS_getAcounts_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#User"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="GETseeSWS_getAcounts_getAcountsReturn_OUT">
        <process:parameterName>GETseeSWS_getAcounts_getAcountsReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#SavingAccount"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="GETseeSWS_getAcounts">
        <process:hasPrecondition rdf:resource="#logged_in"/>
        <process:hasInput rdf:resource="GETseeSWS_getAcounts_user_IN"/>
        <process:hasOutput rdf:resource="GETseeSWS_getAcounts_getAcountsReturn_OUT"/>
    </process:AtomicProcess>
    <!--Definitions for Atomic Process : GETseeSWS_getInvoices-->
    <!--Inputs-->
    <process:Input rdf:ID="GETseeSWS_getInvoices_user_IN">
        <process:parameterName>GETseeSWS_getInvoices_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#User"/>
    </process:Input>
    <process:Input rdf:ID="GETseeSWS_getInvoices_acount_IN">
        <process:parameterName>GETseeSWS_getInvoices_acount_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#SavingAccount"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="GETseeSWS_getInvoices_getInvoicesReturn_OUT">
        <process:parameterName>GETseeSWS_getInvoices_getInvoicesReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#Invoices_payment"/>
    </process:Output>
    <!--Process-->
```

```
    <process:AtomicProcess rdf:ID="GETseeSWS_getInvoices">
        <process:hasPrecondition rdf:resource="#logged_in"/>
        <process:hasInput rdf:resource="GETseeSWS_getInvoices_user_IN"/>
        <process:hasInput rdf:resource="GETseeSWS_getInvoices_acount_IN"/>
        <process:hasOutput rdf:resource="GETseeSWS_getInvoices_getInvoicesReturn_OUT"/>
    </process:AtomicProcess>
    <!--Definitions for Atomic Process : GETseeSWS_getbalance-->
    <!--Inputs-->
    <process:Input rdf:ID="GETseeSWS_getbalance_user_IN">
        <process:parameterName>GETseeSWS_getbalance_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#User"/>
    </process:Input>
    <process:Input rdf:ID="GETseeSWS_getbalance_acount_IN">
        <process:parameterName>GETseeSWS_getbalance_acount_IN</process:parameterName>
        <process:parameterType rdf:resource="&GETseeDomain;#SavingAccount"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="GETseeSWS_getbalance_getbalanceReturn_OUT">
        <process:parameterName>GETseeSWS_getbalance_getbalanceReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#long"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="GETseeSWS_getbalance">
        <process:hasPrecondition rdf:resource="#logged_in"/>
        <process:hasInput rdf:resource="GETseeSWS_getbalance_user_IN"/>
        <process:hasInput rdf:resource="GETseeSWS_getbalance_acount_IN"/>
        <process:hasOutput rdf:resource="GETseeSWS_getbalance_getbalanceReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.1.4 GETseeSWS Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY profileHierarchy "http://users.isoco.net/~slosada/swws/hierarchybank.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/GETseeSWSProcessModel.owl">
    <!ENTITY GETseeService "http://users.isoco.net/~slosada/swws/GETseeSWSService.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/GETseeService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:actor="&actor;#" xmlns:xsd="&xsd;"
xmlns:service="&service;#" xmlns:process="&process;#" xmlns:profile="&profile;#"
xmlns:profileHierarchy="&profileHierarchy;#" xmlns:GETseeService="&GETseeService;#"
xmlns:service_file="&service_file;#" xmlns:pm_file="&pm_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S ServiceProfileEmitter naveen Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&pm_file;"/>
```

```
  </owl:Ontology>
  <profile:Login rdf:ID="GETseeSWSlogin">
       <service:presentedBy rdf:resource="&service_file;#GETseeSWSloginService"/>
       <profile:has_process rdf:resource="&pm_file;#GETseeSWSloginProcess"/>
       <profile:serviceName>Login_GETsee </profile:serviceName>
       <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
       <profile:contactInformation>
            <actor:Actor rdf:about="#Login_GETsee">
                 <actor:title> Service Representative </actor:title>
                 <actor:phone>123 456 789 </actor:phone>
                 <actor:physicalAddress>
            Madrid
         Spain
    </actor:physicalAddress>
                 <actor:fax>123 456 789 </actor:fax>
                 <actor:name>Login_Agent</actor:name>
                 <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
       </profile:contactInformation>
       <!-- proceso login -->
       <profile:hasEffect rdf:ID="&pm_file;logged_in"/>
       <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_login_user_IN"/>
       <profile:hasOutput rdf:resource="&pm_file;#GETseeSWS_login_loginReturn_OUT"/>
  </profile:Login>
  <!-- proceso closeSesion-->
  <profile:Closesession rdf:ID="GETseeSWScloseSession">
       <service:presentedBy rdf:resource="&service_file;#GETseeSWScloseSessionService"/>
       <profile:has_process rdf:resource="&pm_file;#GETseeSWScloseSessionProcess"/>
       <profile:serviceName>closesessio_GETsee </profile:serviceName>
       <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
       <profile:contactInformation>
            <actor:Actor rdf:about="#closeSession_GETsee">
                 <actor:title> Service Representative </actor:title>
                 <actor:phone>123 456 789 </actor:phone>
                 <actor:physicalAddress>
            Madrid
         Spain
    </actor:physicalAddress>
                 <actor:fax>123 456 789 </actor:fax>
                 <actor:name>Login_Agent</actor:name>
                 <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
       </profile:contactInformation>
       <profile:hasPrecondition rdf:ID="&pm_file;logged_in"/>
       <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_closeSesion_user_IN"/>
       <profile:hasOutput rdf:resource="&pm_file;#GETseeSWS_closeSesion_closeSesionReturn_OUT"/>
  </profile:Closesession>
  <!-- proceso getAcounts-->
  <profileHierarchy:Getaccounts rdf:ID="GETseeSWSgetAccounts">
       <service:presentedBy rdf:resource="&service_file;#GETseeSWSgetAccountsService"/>
       <profile:has_process rdf:resource="&pm_file;#GETseeSWSgetAccountsProcess"/>
       <profile:serviceName>Getaccounts_GETsee </profile:serviceName>
       <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
       <profile:contactInformation>
            <actor:Actor rdf:about="#Getaccounts_GETsee">
                 <actor:title> Service Representative </actor:title>
```

```
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Getaccounts_Agent</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasPrecondition rdf:ID="&pm_file;logged_in"/>
        <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_getAcounts_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#GETseeSWS_getAcounts_getAcountsReturn_OUT"/>
    </profileHierarchy:Getaccounts>
    <!-- proceso getInvoices-->
    <profileHierarchy:Getinvoices rdf:ID="GETseeSWSgetinvoices">
        <service:presentedBy rdf:resource="&service_file;#GETseeSWSgetInvoicesService"/>
        <profile:has_process rdf:resource="&pm_file;#GETseeSWSgetInvoicesProcess"/>
        <profile:serviceName>Getinvoices_GETsee </profile:serviceName>
        <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Getinvoices_GETsee">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Getinvoices_Agent</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasPrecondition rdf:ID="&pm_file;logged_in"/>
        <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_getInvoices_user_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_getInvoices_acount_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#GETseeSWS_getInvoices_getInvoicesReturn_OUT"/>
    </profileHierarchy:Getinvoices>
    <!-- proceso getBalance-->
    <profileHierarchy:Getbalance rdf:ID="GETseeSWSgetBalance">
        <service:presentedBy rdf:resource="&service_file;#GETseeSWSgetbalance"/>
        <profile:has_process rdf:resource="&pm_file;#GETseeSWSgetBalanceProcess"/>
        <profile:serviceName>Getbalance_GETsee </profile:serviceName>
        <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Getbalance_GETsee">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Getbalance_Agent</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasPrecondition rdf:ID="&pm_file;logged_in"/>
```

```
        <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_getbalance_user_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#GETseeSWS_getbalance_acount_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#GETseeSWS_getbalance_getbalanceReturn_OUT"/>
    </profileHierarchy:Getbalance>
</rdf:RDF>
```

6.2.1.5 GETseeSWS Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY GETseeDomain "http://users.isoco.net/~slosada/swws/ProductsDescriptions.owl">
    <!ENTITY GETseeSWSwsdl "http://users.isoco.net/~slosada/swws/GETseeSWS.wsdl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/GETseeSWSProcessModel.owl">
    <!ENTITY GETseeService "http://users.isoco.net/~slosada/swws/GETseeSWSService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:GETseeService="&GETseeService;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="GETseeSWSloginGrounding">
        <service:supportedBy rdf:resource="&GETseeService;#GETseeSWSloginService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#GETseeSWS_login"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="GETseeSWScloseSessionGrounding">
        <service:supportedBy rdf:resource="&GETseeService;#GETseeSWScloseSessionService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#GETseeSWS_closeSesion"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="GETseeSWSgetBalanceGrounding">
        <service:supportedBy rdf:resource="&GETseeService;#GETseeSWSgetBalanceService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#GETseeSWS_getbalance"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="GETseeSWSgetAccountsGrounding">
        <service:supportedBy rdf:resource="&GETseeService;#GETseeSWSgetAccountsService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#GETseeSWS_getAcounts"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="GETseeSWSgetInvoicesGrounding">
        <service:supportedBy rdf:resource="&GETseeService;#GETseeSWSgetInvoicesService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#GETseeSWS_getInvoices"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_GETseeSWS_login">
        <grounding:owlsProcess rdf:resource="&pm_file;#GETseeSWS_login"/>
```

```
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#login"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#loginRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_login_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#loginResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_login_loginReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#loginReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_GETseeSWS_closeSesion">
        <grounding:owlsProcess rdf:resource="&pm_file;#GETseeSWS_closeSesion"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#closeSesion"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#closeSesionRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_closeSesion_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#closeSesionResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#GETseeSWS_closeSesion_closeSesionReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#closeSesionReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_GETseeSWS_getAcounts">
```

```
        <grounding:owlsProcess rdf:resource="&pm_file;#GETseeSWS_getAcounts"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getAcounts"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getAcountsRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_getAcounts_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getAcountsResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#GETseeSWS_getAcounts_getAcountsReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#getAcountsReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_GETseeSWS_getInvoices">
        <grounding:owlsProcess rdf:resource="&pm_file;#GETseeSWS_getInvoices"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getInvoices"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getInvoicesRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_getInvoices_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_getInvoices_acount_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#acount"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getInvoicesResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#GETseeSWS_getInvoices_getInvoicesReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#getInvoicesReturn"/>
```

```
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_GETseeSWS_getbalance">
        <grounding:owlsProcess rdf:resource="&pm_file;#GETseeSWS_getbalance"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getbalance"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getbalanceRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_getbalance_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#GETseeSWS_getbalance_acount_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#acount"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="GETseeSWSwsdl#getbalanceResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#GETseeSWS_getbalance_getbalanceReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="GETseeSWSwsdl#getbalanceReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.2 Notification Service

6.2.2.1 Notification WSDL

```
<wsdl:definitions xmlns:S_Notification="http://users.isoco.net/~slosada/swws/Notification.owl#"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://users.isoco.net/~slosada/swws/">
```

```
    <wsdl:types>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/Notification.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="User">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item" type="S_Notification:User"/>
                </sequence>
            </complexType>
        </schema>
    </wsdl:types>
    <wsdl:message name="sendRequest">
        <wsdl:part name="user" type="S_Notification:User"/>
    </wsdl:message>
    <wsdl:message name="sendResponse">
        <wsdl:part name="sendReturn" type="xsd:boolean"/>
    </wsdl:message>
    <wsdl:portType name="notification">
        <wsdl:operation name="send" parameterOrder="Notification_IN message">
            <wsdl:input name="sendRequest" message="intf:sendRequest"/>
            <wsdl:output name="sendResponse" message="intf:sendResponse"/>
        </wsdl:operation>
    </wsdl:portType>
    <wsdl:binding name="notificationSoapBinding" type="intf:notification">
        <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
        <wsdl:operation name="send">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="notificationService">
        <wsdl:port name="notification" binding="intf:notificationSoapBinding">
            <wsdlsoap:address location="http://users.isoco.net/~slosada/swws/services/notification"/>
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

6.2.2.2 Notification Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/NotificationProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/NotificationServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/NotificationGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:my_process="&my_process;#" xmlns:my_profile="&my_profile;#" xmlns:my_grounding="&my_grounding;#">
    <owl:Ontology about="">
```

```
        <rdfs:comment> ---Add Comment--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
    </owl:Ontology>
    <service:Service rdf:ID="notificationSendService">
        <service:presents rdf:resource="&my_profile;#notificationSendProfile"/>
        <service:describedBy rdf:resource="&my_process;#notificationSendProcess"/>
        <service:supports rdf:resource="&my_grounding;#notificationSendGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.2.3 Notification Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY S_Notification "http://users.isoco.net/~slosada/swws/Notificaton.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:S_Notification="&S_Notification;#" xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment>  </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&S_Notification;"/>
    </owl:Ontology>
    <owl:Class rdf:ID="conditionEffect">
        <!--<rdfs:subClassOf rdf:ID="&process;#Condition"/>
    <rdfs:subClassOf rdf:ID="&process;#Effect"/>-->
    </owl:Class>
    <conditionEffect rdf:ID="notification_send"/>
    <process:ProcessModel rdf:ID="notificationSendProcess">
        <process:hasProcess rdf:resource="#notification_send_atomic"/>
        <service:describes rdf:resource="&service_file;#notificationSendService"/>
    </process:ProcessModel>
    <!--Inputs-->
    <process:Input rdf:ID="notification_send_user_IN">
        <process:parameterName>notification_send_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&S_Notification;#Notification"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="notification_send_sendReturn_OUT">
        <process:parameterName>notification_send_sendReturn_OUT</process:parameterName>
```

```
        <process:parameterType rdf:resource="&xsd;#string"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="notification_send_atomic">
        <process:hasEffect rdf:ID="notification_send"/>
        <process:hasInput rdf:resource="notification_send_message_IN"/>
        <process:hasOutput rdf:resource="notification_send_sendReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.2.4 Notification Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationProcessModel.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:actor="&actor;#" xmlns:pm_file="&pm_file;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&pm_file;"/>
    </owl:Ontology>
    <profile:Profile rdf:ID="notificationSendProfile">
        <service:presentedBy rdf:resource="&service_file;#notificationSendService"/>
        <profile:has_process rdf:resource="&pm_file;#notificationSendProcess"/>
        <profile:serviceName>Notification_SendMail</profile:serviceName>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Notification_Send">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
       </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Notification_Send</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasEffect rdf:resource="&pm_file;#notification_send"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_send_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#notification_send_sendReturn_OUT"/>
    </profile:Profile>
</rdf:RDF>
```

6.2.2.5 Notification Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY notification_wsdl "http://users.isoco.net/~slosada/swws/Notification.wsdl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationService.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationProcessModel.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:service_file="&service_file;#" xmlns:notification_wsdl="&notification_wsdl;#" xmlns:pm_file="&pm_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment/>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="notificationSendGrounding">
        <service:supportedBy rdf:resource="&service_file;#notificationSendMailService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#notification_send"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_notification_send">
        <grounding:owlsProcess rdf:resource="&pm_file;#notification_send_atomic"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&notification_wsdl;#send"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_send_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_send_sendReturn_OUT"/>
                <grounding:wsdlMessagePart>
```

```
                <xsd:uriReference rdf:value="&notification_wsdl;#sendReturn"/>
            </grounding:wsdlMessagePart>
        </grounding:WsdlMessageMap>
    </grounding:wsdlOutputMessageParts>
    <grounding:wsdlReference>
        <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
    </grounding:wsdlReference>
</grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.3 EstimationParameter Service

6.2.3.1 EstimationParameter WSDL

```
<wsdl:definitions xmlns:estimation="http://users.isoco.net/~slosada/swws/Estimation.owl#"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://users.isoco.net/~slosada/swws/">
    <wsdl:types>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/Estimation.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="dataAverage">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item" type="estimation:average"/>
                </sequence>
            </complexType>
        </schema>
    </wsdl:types>
    <wsdl:message name="averageEstimationResponse">
        <wsdl:part name="averageEstimationReturn" type="xsd:long"/>
    </wsdl:message>
    <wsdl:message name="averageEstimationRequest">
        <wsdl:part name="data" type="estimation:dataAverage"/>
    </wsdl:message>
    <wsdl:portType name="estimation">
        <wsdl:operation name="averageEstimation" parameterOrder="data">
            <wsdl:input name="averageEstimationRequest" message="intf:averageEstimationRequest"/>
            <wsdl:output name="averageEstimationResponse" message="intf:averageEstimationResponse"/>
        </wsdl:operation>
    </wsdl:portType>
    <wsdl:binding name="estimationSoapBinding" type="intf:estimation">
        <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
        <wsdl:operation name="averageEstimation">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="estimationService">
```

```
        <wsdl:port name="estimation" binding="intf:estimationSoapBinding">
            <wsdlsoap:address location="http://users.isoco.net/~slosada/swws/services/estimation"/>
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

6.2.3.2 EstimationParameter Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/EstimationProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/EstimationServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/EstimationGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:my_process="&my_process;#" xmlns:my_profile="&my_profile;#">
    <owl:Ontology about="">
        <rdfs:comment>  </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
    </owl:Ontology>
    <service:Service rdf:ID="estimationAverageService">
        <service:presents rdf:resource="&my_profile;#estimationAverageProfile"/>
        <service:describedBy rdf:resource="&my_process;#estimationAverageProcess"/>
        <service:supports rdf:resource="&my_grounding;#estimationAverageGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.3.3 EstimationParameter Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY S_Estimation "http://users.isoco.net/~slosada/swws/Estimation.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/EstimationService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:S_Estimation="&S_Estimation;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 $</owl:versionInfo>
        <rdfs:comment>  </rdfs:comment>
```

```
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
    </owl:Ontology>
    <process:ProcessModel rdf:ID="estimationAverageProcess">
        <process:hasProcess rdf:resource="#estimation_averageEstimation"/>
        <service:describes rdf:resource="&service_file;#estimationAverageService"/>
    </process:ProcessModel>
    <!--Definitions for Atomic Process : estimation_averageEstimation-->
    <!--Inputs-->
    <process:Input rdf:ID="estimation_averageEstimation_data_IN">
        <process:parameterName>estimation_averageEstimation_data_IN</process:parameterName>
        <process:parameterType rdf:resource="&S_Estimation;#dataAverage"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="estimation_averageEstimation_averageEstimationReturn_OUT">

    <process:parameterName>estimation_averageEstimation_averageEstimationReturn_OUT</process:parameterNam
e>
        <process:parameterType rdf:resource="&xsd;#long"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="estimation_averageEstimation">
        <process:hasInput rdf:resource="estimation_averageEstimation_data_IN"/>
        <process:hasOutput rdf:resource="estimation_averageEstimation_averageEstimationReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.3.4 EstimationParameter Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/EstimationProcessModel.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/EstimationService.owl">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:actor="&actor;#"
xmlns:service="&service;#" xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:service_file="&service_file;#"
xmlns:pm_file="&pm_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&pm_file;"/>
    </owl:Ontology>
    <profile:Profile rdf:ID="estimationAverageProfile">
```

```
        <service:presentedBy rdf:resource="&service_file;#estimationAverageService"/>
        <profile:has_process rdf:resource="&pm_file;#estimationAverageProcess"/>
        <profile:serviceName>Estimation_average</profile:serviceName>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Estimate_average">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
       </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Estimation_average</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#estimation_averageEstimation_data_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#estimation_averageEstimation_averageEstimationReturn_OUT"/>
    </profile:Profile>
</rdf:RDF>
```

6.2.3.5 EstimationParameter Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY estimation_wsdl "http://users.isoco.net/~slosada/swws/estimation.wsdl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/EstimationProcessModel.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/EstimationService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 $</owl:versionInfo>
        <rdfs:comment> </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="estimationAverageGrounding">
        <service:supportedBy rdf:resource="&service_file;#estimationAverageService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#estimation_averageEstimation"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_estimation_averageEstimation">
        <grounding:owlsProcess rdf:resource="&pm_file;#estimation_averageEstimation"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&estimation_wsdl;#averageEstimation"/>
```

```
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&estimation_wsdl;#averageEstimationRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#estimation_averageEstimation_data_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&estimation_wsdl;#data"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&estimation_wsdl;#averageEstimationResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#estimation_averageEstimation_averageEstimationReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&estimation_wsdl;#averageEstimationReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.4 ServiceBank Service

6.2.4.1 ServiceBank WSDL

```
<wsdl:definitions xmlns:bank="http://users.isoco.net/~slosada/swws/bank.owl#"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:ns="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
targetNamespace="http://users.isoco.net/~slosada/swws/">
    <wsdl:types>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/ProductDescriptionsOwl.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="login">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:login"/>
                </sequence>
            </complexType>
        </schema>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/bank.owl#"
    xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="product_id">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:Product"/>
                </sequence>
            </complexType>
```

```
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/bank.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="password">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:password"/>
            </sequence>
        </complexType>
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/bank.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="service">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:Service"/>
            </sequence>
        </complexType>
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/bank.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="product">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:Product"/>
            </sequence>
        </complexType>
    </schema>
    <schema targetNamespace="http://users.isoco.net/~slosada/swws/bank.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
        <complexType name="payment">
            <sequence>
                <element maxOccurs="unbounded" minOccurs="0" name="item" type="bank:Payment"/>
            </sequence>
        </complexType>
    </schema>
</wsdl:types>
<wsdl:message name="closeSesionResponse">
    <wsdl:part name="closeSesionReturn" type="xsd:boolean"/>
</wsdl:message>
<wsdl:message name="loginRequest">
    <wsdl:part name="user" type="bank:login"/>
    <wsdl:part name="password" type="bank:password"/>
</wsdl:message>
<wsdl:message name="getBalanceResponse">
    <wsdl:part name="getBalanceReturn" type="xsd:long"/>
</wsdl:message>
<wsdl:message name="getServicesResponse">
    <wsdl:part name="getServicesReturn" type="bank:service"/>
</wsdl:message>
<wsdl:message name="getPaymentsRequest">
    <wsdl:part name="user" type="bank:login"/>
</wsdl:message>
<wsdl:message name="getProductsResponse">
    <wsdl:part name="getProductsReturn" type="bank:product"/>
</wsdl:message>
<wsdl:message name="getPaymentsResponse">
    <wsdl:part name="getPaymentsReturn" type="bank:payment"/>
</wsdl:message>
<wsdl:message name="getServicesRequest">
    <wsdl:part name="user" type="bank:login"/>
</wsdl:message>
<wsdl:message name="getBalanceRequest">
    <wsdl:part name="user" type="bank:login"/>
    <wsdl:part name="product" type="bank:product"/>
```

```
</wsdl:message>
<wsdl:message name="loginResponse">
    <wsdl:part name="loginReturn" type="xsd:boolean"/>
</wsdl:message>
<wsdl:message name="getProductsRequest">
    <wsdl:part name="user" type="bank:login"/>
</wsdl:message>
<wsdl:message name="closeSesionRequest">
    <wsdl:part name="user" type="bank:login"/>
</wsdl:message>
<wsdl:portType name="ServiceBank">
    <wsdl:operation name="getServices" parameterOrder="user">
        <wsdl:input name="getServicesRequest" message="intf:getServicesRequest"/>
        <wsdl:output name="getServicesResponse" message="intf:getServicesResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getProducts" parameterOrder="user">
        <wsdl:input name="getProductsRequest" message="intf:getProductsRequest"/>
        <wsdl:output name="getProductsResponse" message="intf:getProductsResponse"/>
    </wsdl:operation>
    <wsdl:operation name="login" parameterOrder="user password">
        <wsdl:input name="loginRequest" message="intf:loginRequest"/>
        <wsdl:output name="loginResponse" message="intf:loginResponse"/>
    </wsdl:operation>
    <wsdl:operation name="closeSesion" parameterOrder="user">
        <wsdl:input name="closeSesionRequest" message="intf:closeSesionRequest"/>
        <wsdl:output name="closeSesionResponse" message="intf:closeSesionResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getBalance" parameterOrder="user product_id">
        <wsdl:input name="getBalanceRequest" message="intf:getBalanceRequest"/>
        <wsdl:output name="getBalanceResponse" message="intf:getBalanceResponse"/>
    </wsdl:operation>
    <wsdl:operation name="getPayments" parameterOrder="user">
        <wsdl:input name="getPaymentsRequest" message="intf:getPaymentsRequest"/>
        <wsdl:output name="getPaymentsResponse" message="intf:getPaymentsResponse"/>
    </wsdl:operation>
</wsdl:portType>
<wsdl:binding name="ServiceBankSoapBinding" type="intf:ServiceBank">
    <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
    <wsdl:operation name="getServices">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="getProducts">
        <wsdlsoap:operation/>
        <wsdl:input>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:input>
        <wsdl:output>
            <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
    namespace="http://users.isoco.net/~slosada/swws/"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="login">
        <wsdlsoap:operation/>
```

```
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
        <wsdl:operation name="closeSesion">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
        <wsdl:operation name="getBalance">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
        <wsdl:operation name="getPayments">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
        namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="ServiceBankService">
        <wsdl:port name="ServiceBank" binding="intf:ServiceBankSoapBinding">
            <wsdlsoap:address location="http://users.isoco.net/~slosada/swws/services/ServiceBank"/>
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

6.2.4.2 ServiceBank Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
```

```
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/ServiceBankProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/ServiceBankServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/ServiceBankGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:my_process="&my_process;#" xmlns:my_profile="&my_profile;#">
    <owl:Ontology about="">
        <rdfs:comment> ---Add Comment--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
    </owl:Ontology>
    <service:Service rdf:ID="ServiceBankloginService">
        <service:presents rdf:resource="&my_profile;#ServiceBankloginProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankloginProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankloginGrounding"/>
    </service:Service>
    <service:Service rdf:ID="ServiceBankgetProductsService">
        <service:presents rdf:resource="&my_profile;#ServiceBankgetProductsProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankgetProductsProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankgetProductsGrounding"/>
    </service:Service>
    <service:Service rdf:ID="ServiceBankcloseSesionService">
        <service:presents rdf:resource="&my_profile;#ServiceBankcloseSesionProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankcloseSesionProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankcloseSesionGrounding"/>
    </service:Service>
    <service:Service rdf:ID="ServiceBankgetServicesService">
        <service:presents rdf:resource="&my_profile;#ServiceBankgetServicesProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankgetServicesProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankgetServicesGrounding"/>
    </service:Service>
    <service:Service rdf:ID="ServiceBankgetPaymentsService">
        <service:presents rdf:resource="&my_profile;#ServiceBankgetPaymentsProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankgetPaymentsProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankgetPaymentsGrounding"/>
    </service:Service>
    <service:Service rdf:ID="ServiceBankgetBalanceService">
        <service:presents rdf:resource="&my_profile;#ServiceBankgetBalanceProfile"/>
        <service:describedBy rdf:resource="&my_process;#ServiceBankgetBalanceProcess"/>
        <service:supports rdf:resource="&my_grounding;#ServiceBankgetBalanceGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.4.3 ServiceBank Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/ServiceBankService.owl">
```

```
    <!ENTITY BankDomain "http://users.isoco.net/~slosada/swws/bank.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:BankDomain="&BankDomain;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 $</owl:versionInfo>
        <rdfs:comment>  </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&BankDomain;"/>
    </owl:Ontology>
    <owl:Class rdf:ID="conditionEffect">
        <rdfs:subClassOf rdf:resource="&process;#Condition"/>
        <rdfs:subClassOf rdf:resource="&process;#Effect"/>
    </owl:Class>
    <conditionEffect rdf:ID="logged_in"/>
    <process:ProcessModel rdf:ID="ServiceBankgetServices">
        <process:hasProcess rdf:resource="#ServiceBank_getServices"/>
        <service:describes rdf:resource="&service_file;#ServiceBankgetServicesService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="ServiceBankgetProductsProcess">
        <process:hasProcess rdf:resource="#ServiceBank_getProducts"/>
        <service:describes rdf:resource="&service_file;#ServiceBankgetProductsServic"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="ServiceBankloginProcess">
        <process:hasProcess rdf:resource="#ServiceBank_login"/>
        <service:describes rdf:resource="&service_file;#ServiceBankloginService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="ServiceBankcloseSessionProcess">
        <process:hasProcess rdf:resource="#ServiceBank_closeSesion"/>
        <service:describes rdf:resource="&service_file;#ServiceBankcloseSessionService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="ServiceBankgetBalanceProcess">
        <process:hasProcess rdf:resource="#ServiceBank_getBalance"/>
        <service:describes rdf:resource="&service_file;#ServiceBankgetBalanceService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="ServiceBankgetPaymentsProcess">
        <process:hasProcess rdf:resource="#ServiceBank_getPayments"/>
        <service:describes rdf:resource="&service_file;#ServiceBankgetPaymentsService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="AddProcessModelName">
        <process:hasProcess rdf:resource="AddProcessName"/>
        <service:describes rdf:resource="AddServiceName"/>
    </process:ProcessModel>
    <!--Definitions for Atomic Process : ServiceBank_getServices-->
    <!--Inputs-->
    <process:Input rdf:ID="ServiceBank_getServices_user_IN">
        <process:parameterName>ServiceBank_getServices_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&BankDomain;#login"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="ServiceBank_getServices_getServicesReturn_OUT">
        <process:parameterName>ServiceBank_getServices_getServicesReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&BankDomain;#service"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="ServiceBank_getServices">
        <process:hasInput rdf:resource="ServiceBank_getServices_user_IN"/>
```

```
    <process:hasOutput rdf:resource="ServiceBank_getServices_getServicesReturn_OUT"/>
</process:AtomicProcess>
<!--Definitions for Atomic Process : ServiceBank_getProducts-->
<!--Inputs-->
<process:Input rdf:ID="ServiceBank_getProducts_user_IN">
    <process:parameterName>ServiceBank_getProducts_user_IN</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#login"/>
</process:Input>
<!--Outputs-->
<process:Output rdf:ID="ServiceBank_getProducts_getProductsReturn_OUT">
    <process:parameterName>ServiceBank_getProducts_getProductsReturn_OUT</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#product"/>
</process:Output>
<!--Process-->
<process:AtomicProcess rdf:ID="ServiceBank_getProducts">
    <process:hasInput rdf:resource="ServiceBank_getProducts_user_IN"/>
    <process:hasOutput rdf:resource="ServiceBank_getProducts_getProductsReturn_OUT"/>
</process:AtomicProcess>
<!--Definitions for Atomic Process : ServiceBank_login-->
<!--Inputs-->
<process:Input rdf:ID="ServiceBank_login_password_IN">
    <process:parameterName>ServiceBank_login_password_IN</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#password"/>
</process:Input>
<process:Input rdf:ID="ServiceBank_login_user_IN">
    <process:parameterName>ServiceBank_login_user_IN</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#login"/>
</process:Input>
<!--Outputs-->
<process:Output rdf:ID="ServiceBank_login_loginReturn_OUT">
    <process:parameterName>ServiceBank_login_loginReturn_OUT</process:parameterName>
    <process:parameterType rdf:resource="&xsd;#boolean"/>
</process:Output>
<!--Process-->
<process:AtomicProcess rdf:ID="ServiceBank_login">
    <process:hasInput rdf:resource="ServiceBank_login_password_IN"/>
    <process:hasInput rdf:resource="ServiceBank_login_user_IN"/>
    <process:hasOutput rdf:resource="ServiceBank_login_loginReturn_OUT"/>
</process:AtomicProcess>
<!--Definitions for Atomic Process : ServiceBank_closeSesion-->
<!--Inputs-->
<process:Input rdf:ID="ServiceBank_closeSesion_user_IN">
    <process:parameterName>ServiceBank_closeSesion_user_IN</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#login"/>
</process:Input>
<!--Outputs-->
<process:Output rdf:ID="ServiceBank_closeSesion_closeSesionReturn_OUT">
    <process:parameterName>ServiceBank_closeSesion_closeSesionReturn_OUT</process:parameterName>
    <process:parameterType rdf:resource="&xsd;#boolean"/>
</process:Output>
<!--Process-->
<process:AtomicProcess rdf:ID="ServiceBank_closeSesion">
    <process:hasInput rdf:resource="ServiceBank_closeSesion_user_IN"/>
    <process:hasOutput rdf:resource="ServiceBank_closeSesion_closeSesionReturn_OUT"/>
</process:AtomicProcess>
<!--Definitions for Atomic Process : ServiceBank_getbBalance-->
<!--Inputs-->
<process:Input rdf:ID="ServiceBank_getbBalance_product_IN">
    <process:parameterName>ServiceBank_getbBalance_product_IN</process:parameterName>
    <process:parameterType rdf:resource="&BankDomain;#product"/>
</process:Input>
<process:Input rdf:ID="ServiceBank_getbBalance_user_IN">
```

```
        <process:parameterName>ServiceBank_getbBalance_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&BankDomain;#login"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="ServiceBank_getbBalance_getbBalanceReturn_OUT">
        <process:parameterName>ServiceBank_getbBalance_getbBalanceReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#long"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="ServiceBank_getbBalance">
        <process:hasInput rdf:resource="ServiceBank_getbBalance_product_IN"/>
        <process:hasInput rdf:resource="ServiceBank_getbBalance_user_IN"/>
        <process:hasOutput rdf:resource="ServiceBank_getbBalance_getbBalanceReturn_OUT"/>
    </process:AtomicProcess>
    <!--Definitions for Atomic Process : ServiceBank_getPayments-->
    <!--Inputs-->
    <process:Input rdf:ID="ServiceBank_getPayments_user_IN">
        <process:parameterName>ServiceBank_getPayments_user_IN</process:parameterName>
        <process:parameterType rdf:resource="&BankDomain;#login"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="ServiceBank_getPayments_getPaymentsReturn_OUT">
        <process:parameterName>ServiceBank_getPayments_getPaymentsReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&BankDomain;#payment"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="ServiceBank_getPayments">
        <process:hasInput rdf:resource="ServiceBank_getPayments_user_IN"/>
        <process:hasOutput rdf:resource="ServiceBank_getPayments_getPaymentsReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.4.4 ServiceBank Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
    <!ENTITY profileHierarchy "http://users.isoco.net/~slosada/swws/hierarchybank.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/ServiceBankProcessModel.owl">
    <!ENTITY GETseeService "http://users.isoco.net/~slosada/swws/ServiceBankService.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/ServiceBankService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:actor="&actor;#" xmlns:pm_file="&pm_file;#"
xmlns:profileHierarchy="&profileHierarchy;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0  slosada Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
```

```
        <owl:imports rdf:resource="&pm_file;"/>
    </owl:Ontology>
    <profileHierarchy:GetProducts rdf:ID="ServiceBankgetProductsProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankgetProductsService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankgetProductsProcess"/>
        <profile:serviceName>GetProducts </profile:serviceName>
        <profile:textDescription>
      Allow login in GETsee aplication
  </profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
     </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>" "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getProducts_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_getProducts_getProductsReturn_OUT"/>
        <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    </profileHierarchy:GetProducts>
    <profile:login rdf:ID="ServiceBankloginProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankloginService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankloginProcess"/>
        <profile:serviceName>Login </profile:serviceName>
        <profile:textDescription>
      Allow login in GETsee aplication
  </profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Login">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
     </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>" "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_login_password_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_login_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_login_loginReturn_OUT"/>
        <profile:hasEffect rdf:resource="&pm_file;logged_in"/>
    </profile:login>
    <profile:close rdf:ID="ServiceBankcloseSesionsProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankcloseSesionService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankcloseSesionProcess"/>
        <profile:serviceName>closeSesion </profile:serviceName>
        <profile:textDescription>
      Allow login in GETsee aplication
  </profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
```

```
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>" "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_closeSesion_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_closeSesion_closeSesionReturn_OUT"/>
        <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    </profile:close>
    <profileHierarchy:GetServices rdf:ID="ServiceBankgetServicesProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankgetServicesService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankgetServicesProcess"/>
        <profile:serviceName>GetServices </profile:serviceName>
        <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>" "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getServices_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_getServices_getServicesReturn_OUT"/>
        <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    </profileHierarchy:GetServices>
    <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getBalance_product_IN"/>
    <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getBalance_user_IN"/>
    <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_getBalance_getBalanceReturn_OUT"/>
    <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    <profileHierarchy:GetPayments rdf:ID="ServiceBankgetPaymentsProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankgetPaymentsService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankgetPaymentsProcess"/>
        <profile:serviceName>GetPayments </profile:serviceName>
        <profile:textDescription>
    Allow login in GETsee aplication
</profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
        Spain
    </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name> " "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getPayments_user_IN"/>
```

```
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_getPayments_getPaymentsReturn_OUT"/>
        <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    </profileHierarchy:GetPayments>
    <profileHierarchy:Getbalance rdf:ID="ServiceBankgetBalanceProfile">
        <service:presentedBy rdf:resource="&service_file;#ServiceBankgetBalanceService"/>
        <profile:has_process rdf:resource="&pm_file;#ServiceBankgetBalanceProcess"/>
        <profile:serviceName>GetPayments </profile:serviceName>
        <profile:textDescription>
      Allow login in GETsee aplication
   </profile:textDescription>
        <profile:contactInformation>
            <actor:Actor rdf:about="">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
                Madrid
              Spain
      </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name> " "</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getBalance_product_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#ServiceBank_getBalance_user_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#ServiceBank_getBalance_getBalanceReturn_OUT"/>
        <profile:hasPrecondition rdf:resource="&pm_file;#logged_in"/>
    </profileHierarchy:Getbalance>
</rdf:RDF>
```

6.2.4.5 ServiceBank Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY BankDomain "http://users.isoco.net/~slosada/swws/bank.owl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/ServiceBankProcessModel.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/ServiceBankService.owl">
    <!ENTITY ServiceBankwsdl "http://users.isoco.net/~slosada/swws/ServiceBank.wsdl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:service_file="&service_file;#" xmlns:ServiceBankwsdl="&ServiceBankwsdl;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWLS 1.0 $</owl:versionInfo>
        <rdfs:comment> </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
```

```
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="ServiceBankloginGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankloginService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_login"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="ServiceBankcloseSessionGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankcloseSessionService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_closeSession"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="ServiceBankgetServicesGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankgetServicesService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_getServices"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="ServiceBankgetProductsGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankgetProductsService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_getProducts"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="ServiceBankgetBalanceGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankgetBalanceService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_getBalance"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlGrounding rdf:ID="ServiceBankgetPaymentsGrounding">
        <service:supportedBy rdf:resource="&service_file;#ServiceBankgetPaymentsService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#ServiceBank_getPayments"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_getSErvices">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_getServices"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getServices"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getServicesRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_getServices_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getServicesResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#ServiceBank_getServices_getServicesReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#getServicesReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_getProducts">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_getProducts"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getProducts"/>
```

```
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getProductsRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_getProducts_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getProductsResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#ServiceBank_getProducts_getProductsReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#getProductsReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_login">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_login"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#login"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#loginRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_login_password_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#password"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_login_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#loginResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_login_loginReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#loginReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
```

```
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_closeSession">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_closeSession"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#closeSession"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#closeSessionRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_closeSession_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#closeSessionResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#ServiceBank_closeSession_closeSessionReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#closeSessionReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_getBalance">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_getBalance"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getBalance"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getBalanceRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_getBalance_product_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#product"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_getBalance_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getBalanceResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
```

```
                <grounding:owlsParameter
rdf:resource="&pm_file;#ServiceBank_getBalance_getBalanceReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#getBalanceReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_ServiceBank_getPayments">
        <grounding:owlsProcess rdf:resource="&pm_file;#ServiceBank_getPayments"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getPayments"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getPaymentsRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#ServiceBank_getPayments_user_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#user"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&ServiceBankwsdl;#getPaymentsResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter
rdf:resource="&pm_file;#ServiceBank_getPayments_getPaymentsReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&ServiceBankwsdl;#getPaymentsReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.5 NotificationMail Service

6.2.5.1 NotificationMail WSDL

```
<wsdl:definitions xmlns:S_Notification="http://users.isoco.net/~slosada/swws/NotificationMail.owl#"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://users.isoco.net/~slosada/swws/">
    <wsdl:types>
```

```
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/NotificationMail.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="emd_toEmail">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item"
type="S_Notification:emd_toEmail"/>
                </sequence>
            </complexType>
        </schema>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/NotificationMail.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="emd_subject">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item"
type="S_Notification:emd_subject"/>
                </sequence>
            </complexType>
        </schema>
    </wsdl:types>
    <wsdl:message name="sendMailRequest">
        <wsdl:part name="to" type="S_Notification:emd_toEmail"/>
        <wsdl:part name="subject" type="S_Notification:emd_subject"/>
        <wsdl:part name="body" type="xsd:string"/>
    </wsdl:message>
    <wsdl:message name="sendMailResponse">
        <wsdl:part name="sendMailReturn" type="xsd:string"/>
    </wsdl:message>
    <wsdl:portType name="notification">
        <wsdl:operation name="sendMail" parameterOrder="to subject body">
            <wsdl:input name="sendMailRequest" message="intf:sendMailRequest"/>
            <wsdl:output name="sendMailResponse" message="intf:sendMailResponse"/>
        </wsdl:operation>
    </wsdl:portType>
    <wsdl:binding name="notificationSoapBinding" type="intf:notification">
        <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
        <wsdl:operation name="sendMail">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="notificationService">
        <wsdl:port name="notification" binding="intf:notificationSoapBinding">
            <wsdlsoap:address location="http://users.isoco.net/~slosada/swws/services/notification"/>
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

6.2.5.2 NotificationMail Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 3 U (http://www.xmlspy.com) by Ozelin (iSOCO) -->
<!DOCTYPE uridef [
```

```
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/NotificationMailProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/NotificationMailServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/NotificationMailGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:my_process="&my_process;#" xmlns:my_profile="&my_profile;#">
    <owl:Ontology about="">
        <rdfs:comment> ---Add Comment--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
        <owl:imports rdf:resource="&my_grounding;"/>
    </owl:Ontology>
    <service:Service rdf:ID="notificationSendMailService">
        <service:presents rdf:resource="&my_profile;#notificationSendMailProfile"/>
        <service:describedBy rdf:resource="&my_process;#notificationSendMailProcess"/>
        <service:supports rdf:resource="&my_grounding;#notificationSendMailGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.5.3 NotificationMail Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY S_Notification "http://users.isoco.net/~slosada/swws/NotificatonMail.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationMailService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:S_Notification="&S_Notification;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
    </owl:Ontology>
    <owl:Class rdf:ID="notification_send">
        <rdf:type rdf:resource="&process;#Condition"/>
        <rdf:type rdf:resource="&process;#Effect"/>
```

```
    </owl:Class>
    <process:ProcessModel rdf:ID="notificationSendMail">
        <process:hasProcess rdf:resource="#notification_sendMail"/>
        <service:describes rdf:resource="&service_file;#notificationSendMailService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="notificationSendSMS">
        <process:hasProcess rdf:resource="#notification_sendSMS"/>
        <service:describes rdf:resource="&service_file;#notificationSendSMSService"/>
    </process:ProcessModel>
    <!--**List of Atomic Processes**-->
    <!--ProcessName :notification_sendMail-->
    <!--Definitions for Atomic Process : notification_sendMail-->
    <process:Effect rdf:ID="notification_send">
        <process:ConditionalEffect>
            <process:ceCondition rdf:resource="#flag_error_notificacion_false"/>
            <process:ceEffect rdf:resource="#notification_send"/>
        </process:ConditionalEffect>
    </process:Effect>
    <!--Inputs-->
    <process:Input rdf:ID="notification_sendMail_to_IN">
        <process:parameterName>notification_sendMail_to_IN</process:parameterName>
        <process:parameterType rdf:resource="&S_Notification;#emd_toEmail"/>
    </process:Input>
    <process:Input rdf:ID="notification_sendMail_subject_IN">
        <process:parameterName>notification_sendMail_subject_IN</process:parameterName>
        <process:parameterType rdf:resource="&S_Notification;#emd_subject"/>
    </process:Input>
    <process:Input rdf:ID="notification_sendMail_body_IN">
        <process:parameterName>notification_sendMail_body_IN</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#string"/>
    </process:Input>
    <!--Outputs-->
    <process:Output rdf:ID="notification_sendMail_sendMailReturn_OUT">
        <process:parameterName>notification_sendMail_sendMailReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#string"/>
    </process:Output>
    <!--Process-->
    <process:AtomicProcess rdf:ID="notification_sendMail">
        <process:hasEffect rdf:ID="notification_send"/>
        <process:hasInput rdf:resource="notification_sendMail_to_IN"/>
        <process:hasInput rdf:resource="notification_sendMail_subject_IN"/>
        <process:hasInput rdf:resource="notification_sendMail_body_IN"/>
        <process:hasOutput rdf:resource="notification_sendMail_sendMailReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.5.4 NotificationMail Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationMailProcessModel.owl">
```

```
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationMailService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:actor="&actor;#"
xmlns:service="&service;#" xmlns:process="&process;#" xmlns:pm_file="&pm_file;#" xmlns:profile="&profile;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 Exp $</owl:versionInfo>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&pm_file;"/>
    </owl:Ontology>
    <profile:Profile rdf:ID="notificationSendMailProfile">
        <service:presentedBy rdf:resource="&service_file;#notificationSendMailService"/>
        <profile:has_process rdf:resource="&pm_file;#notificationSendMailProcess"/>
        <profile:serviceName>Notification_SendMail</profile:serviceName>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Notification_SendMai">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
     </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Notification_SendMai</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasEffect rdf:resource="&pm_file;#notification_send"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_sendMail_to_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_sendMail_subject_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_sendMail_body_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#notification_sendMail_sendMailReturn_OUT"/>
    </profile:Profile>
</rdf:RDF>
```

6.2.5.5 NotificationMail Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY notification_wsdl "http://users.isoco.net/~slosada/swws/NotificationMail.wsdl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationMailService.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationMailProcessModel.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
```

```
        <owl:versionInfo>$Id: OWLS 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="notificationSendMailGrounding">
        <service:supportedBy rdf:resource="&service_file;#notificationSendMailService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#notification_sendMail"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_notification_sendMail">
        <grounding:owlsProcess rdf:resource="&pm_file;#notification_sendMail"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendMail"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendMailRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendMail_to_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#to"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendMail_subject_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#subject"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendMail_body_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#body"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendMailResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendMail_sendMailReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#sendMailReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.6 NotificationSMS Service

6.2.6.1 NotificationSMS WSDL

```
<wsdl:definitions xmlns:S_Notification="http://users.isoco.net/~slosada/swws/NotificationSMS.owl#"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://users.isoco.net/~slosada/swws/-impl" xmlns:intf="http://users.isoco.net/~slosada/swws/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://users.isoco.net/~slosada/swws/">
    <wsdl:types>
        <schema targetNamespace="http://users.isoco.net/~slosada/swws/NotificationSMS.owl#"
xmlns="http://www.w3.org/2001/XMLSchema">
            <complexType name="phn_number">
                <sequence>
                    <element maxOccurs="unbounded" minOccurs="0" name="item"
type="S_Notification:phn_number"/>
                </sequence>
            </complexType>
        </schema>
    </wsdl:types>
    <wsdl:message name="sendSMSRequest">
        <wsdl:part name="Phone_number" type="S_Notification:phn_number"/>
        <wsdl:part name="message" type="xsd:string"/>
    </wsdl:message>
    <wsdl:message name="sendSMSResponse">
        <wsdl:part name="sendSMSReturn" type="xsd:string"/>
    </wsdl:message>
    <wsdl:portType name="notification">
        <wsdl:operation name="sendSMS" parameterOrder="Phone_number message">
            <wsdl:input name="sendSMSRequest" message="intf:sendSMSRequest"/>
            <wsdl:output name="sendSMSResponse" message="intf:sendSMSResponse"/>
        </wsdl:operation>
    </wsdl:portType>
    <wsdl:binding name="notificationSoapBinding" type="intf:notification">
        <wsdlsoap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
        <wsdl:operation name="sendSMS">
            <wsdlsoap:operation/>
            <wsdl:input>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:input>
            <wsdl:output>
                <wsdlsoap:body use="encoded" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
namespace="http://users.isoco.net/~slosada/swws/"/>
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="notificationService">
        <wsdl:port name="notification" binding="intf:notificationSoapBinding">
            <wsdlsoap:address location="http://users.isoco.net/~slosada/swws/services/notification"/>
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

6.2.6.2 NotificationSMS Service Description

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY my_process "http://users.isoco.net/~slosada/swws/NotificationSMSProcessModel.owl">
    <!ENTITY my_profile "http://users.isoco.net/~slosada/swws/NotificationSMSServiceProfile.owl">
    <!ENTITY my_grounding "http://users.isoco.net/~slosada/swws/NotificationSMSGrounding.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#">
    <owl:Ontology about="">
        <rdfs:comment> ---Add Comment--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&my_process;"/>
        <owl:imports rdf:resource="&my_profile;"/>
    </owl:Ontology>
    <service:Service rdf:ID="notificationSendSMSService">
        <service:presents rdf:resource="&my_profile;#notificationSendSMSProfile"/>
        <service:describedBy rdf:resource="&my_process;#notificationSendSMSProcess"/>
        <service:supports rdf:resource="&my_grounding;#notificationSendSMSGrounding"/>
    </service:Service>
</rdf:RDF>
```

6.2.6.3 NotificationSMS Process Model

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY S_Notification "http://users.isoco.net/~slosada/swws/NotificatonSMS.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationSMSService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:S_Notification="&S_Notification;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-SProcessModelEmitter.java,v 1.3 naveen Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
```

```
    </owl:Ontology>
    <owl:Class rdf:ID="notification_send">
        <rdf:type rdf:resource="&process;#Condition"/>
        <rdf:type rdf:resource="&process;#Effect"/>
    </owl:Class>
    <process:ProcessModel rdf:ID="notificationSendMail">
        <process:hasProcess rdf:resource="#notification_sendMail"/>
        <service:describes rdf:resource="&service_file;#notificationSendMailService"/>
    </process:ProcessModel>
    <process:ProcessModel rdf:ID="notificationSendSMS">
        <process:hasProcess rdf:resource="#notification_sendSMS"/>
        <service:describes rdf:resource="&service_file;#notificationSendSMSService"/>
    </process:ProcessModel>
    <!--**List of Atomic Processes**-->
    <!--ProcessName :notification_sendSMS-->
    <process:Effect rdf:ID="notification_send">
        <process:ConditionalEffect>
            <process:ceCondition rdf:resource="#flag_error_notificacion_false"/>
            <process:ceEffect rdf:resource="#notification_send"/>
        </process:ConditionalEffect>
    </process:Effect>
    <process:Input rdf:ID="notification_sendSMS_Phone_number_IN">
        <process:parameterName>notification_sendSMS_Phone_number_IN</process:parameterName>
        <process:parameterType rdf:resource="&S_Notification;#phn_number"/>
    </process:Input>
    <process:Input rdf:ID="notification_sendSMS_message_IN">
        <process:parameterName>notification_sendSMS_message_IN</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#string"/>
    </process:Input>
    <process:Output rdf:ID="notification_sendSMS_sendSMSReturn_OUT">
        <process:parameterName>notification_sendSMS_sendSMSReturn_OUT</process:parameterName>
        <process:parameterType rdf:resource="&xsd;#string"/>
    </process:Output>
    <process:AtomicProcess rdf:ID="notification_sendSMS">
        <process:hasEffect rdf:ID="notification_send"/>
        <process:hasInput rdf:resource="notification_sendSMS_Phone_number_IN"/>
        <process:hasInput rdf:resource="notification_sendSMS_message_IN"/>
        <process:hasOutput rdf:resource="notification_sendSMS_sendSMSReturn_OUT"/>
    </process:AtomicProcess>
</rdf:RDF>
```

6.2.6.4 NotificationSMS Profile

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY actor "http://www.daml.org/services/owl-s/1.0/ActorDefault.owl">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationSMSProcessModel.owl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationSMSService.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:actor="&actor;#"
xmlns:service="&service;#" xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:service_file="&service_file;#">
```

```
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWL-S 1.0 slosada Exp $</owl:versionInfo>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&pm_file;"/>
    </owl:Ontology>
    <profile:Profile rdf:ID="notificationSendSMSProfile">
        <service:presentedBy rdf:resource="&service_file;#notificationSendSMSService"/>
        <profile:has_process rdf:resource="&pm_file;#notificationSendSMSProcess"/>
        <profile:serviceName>Notification_SendMail</profile:serviceName>
        <profile:contactInformation>
            <actor:Actor rdf:about="#Notification_SendMai">
                <actor:title> Service Representative </actor:title>
                <actor:phone>123 456 789 </actor:phone>
                <actor:physicalAddress>
            Madrid
          Spain
     </actor:physicalAddress>
                <actor:fax>123 456 789 </actor:fax>
                <actor:name>Notification_SendMai</actor:name>
                <actor:email>services@isoco.com</actor:email>
            </actor:Actor>
        </profile:contactInformation>
        <profile:hasEffect rdf:resource="notification_send"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_sendSMS_Phone_number_IN"/>
        <profile:hasInput rdf:resource="&pm_file;#notification_sendSMS_message_IN"/>
        <profile:hasOutput rdf:resource="&pm_file;#notification_sendSMS_sendSMSReturn_OUT"/>
    </profile:Profile>
</rdf:RDF>
```

6.2.6.5 NotificationSMS Grounding

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Joe Silver (.) -->
<!DOCTYPE uridef [
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
    <!ENTITY owl "http://www.w3.org/2002/07/owl">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
    <!ENTITY service "http://www.daml.org/services/owl-s/1.0/Service.owl">
    <!ENTITY process "http://www.daml.org/services/owl-s/1.0/Process.owl">
    <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
    <!ENTITY grounding "http://www.daml.org/services/owl-s/1.0/Grounding.owl">
    <!ENTITY notification_wsdl "http://users.isoco.net/~slosada/swws/NotificationSMS.wsdl">
    <!ENTITY service_file "http://users.isoco.net/~slosada/swws/NotificationSMSService.owl">
    <!ENTITY pm_file "http://users.isoco.net/~slosada/swws/NotificationSMSProcessModel.owl">
]>
<rdf:RDF xmlns:rdf="&rdf;#" xmlns:rdfs="&rdfs;#" xmlns:owl="&owl;#" xmlns:xsd="&xsd;" xmlns:service="&service;#"
xmlns:process="&process;#" xmlns:profile="&profile;#" xmlns:grounding="&grounding;#"
xmlns:service_file="&service_file;#">
    <owl:Ontology about="">
        <owl:versionInfo>$Id: OWLS 1.0 slosada Exp $</owl:versionInfo>
        <rdfs:comment> ---Add INFO--- </rdfs:comment>
        <owl:imports rdf:resource="&rdf;"/>
        <owl:imports rdf:resource="&rdfs;"/>
        <owl:imports rdf:resource="&owl;"/>
        <owl:imports rdf:resource="&service;"/>
```

```
        <owl:imports rdf:resource="&process;"/>
        <owl:imports rdf:resource="&profile;"/>
        <owl:imports rdf:resource="&grounding;"/>
    </owl:Ontology>
    <grounding:WsdlGrounding rdf:ID="notificationSendSMSGrounding">
        <service:supportedBy rdf:resource="&service_file;#notificationSendSMSService"/>
        <grounding:hasAtomicProcessGrounding rdf:resource="#notification_sendSMS"/>
    </grounding:WsdlGrounding>
    <grounding:WsdlAtomicProcessGrounding rdf:ID="WSDLGrounding_notification_sendSMS">
        <grounding:owlsProcess rdf:resource="&pm_file;#notification_sendSMS"/>
        <grounding:wsdlOperation>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendSMS"/>
        </grounding:wsdlOperation>
        <grounding:wsdlInputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendSMSRequest"/>
        </grounding:wsdlInputMessage>
        <grounding:wsdlInputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendSMS_Phone_number_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#Phone_number"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendSMS_message_IN"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#message"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlInputMessageParts>
        <grounding:wsdlOutputMessage>
            <xsd:uriReference rdf:value="&notification_wsdl;#sendSMSResponse"/>
        </grounding:wsdlOutputMessage>
        <grounding:wsdlOutputMessageParts rdf:parseType="owl:collection">
            <grounding:WsdlMessageMap>
                <grounding:owlsParameter rdf:resource="&pm_file;#notification_sendSMS_sendSMSReturn_OUT"/>
                <grounding:wsdlMessagePart>
                    <xsd:uriReference rdf:value="&notification_wsdl;#sendSMSReturn"/>
                </grounding:wsdlMessagePart>
            </grounding:WsdlMessageMap>
        </grounding:wsdlOutputMessageParts>
        <grounding:wsdlReference>
            <xsd:uriReference rdf:value="http://www.w3.org/TR/2001/NOTE-wsdl-20010315"/>
        </grounding:wsdlReference>
    </grounding:WsdlAtomicProcessGrounding>
</rdf:RDF>
```

6.2.7 HierarchyBank

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<!DOCTYPE uridef[
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema">
  <!ENTITY owl "http://www.w3.org/2002/07/owl">
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema">
  <!ENTITY time "http://www.ai.sri.com/daml/ontologies/time/Time.owl">
  <!ENTITY profile "http://www.daml.org/services/owl-s/1.0/Profile.owl">
  <!ENTITY DEFAULT "http://www.daml.org/services/owl-s/1.0/ProfileHierarchy.owl">
]>
```

```
<rdf:RDF
  xmlns:rdf="&rdf;#"
  xmlns:rdfs=    "&rdfs;#"
  xmlns:owl = "&owl;#"
  xmlns:xsd=     "&xsd;#"
  xmlns:profile= "&profile;#"
  xml:base="&DEFAULT;#"
  xmlns=    "&DEFAULT;#">

  <owl:Ontology rdf:about="">
    <owl:versionInfo>
      $Id: Hierarchybank.owl,v v 1.0 slosada Exp $
    </owl:versionInfo>
    <rdfs:comment>
    </rdfs:comment>

    <owl:imports rdf:resource="&profile;" />
  </owl:Ontology>
    <owl:Class rdf:ID="Information_Service">
    <rdfs:subClassOf rdf:resource="&profile;#Profile" />
    <rdfs:comment>
    Class that represent all the Information Services
    </rdfs:comment>
  </owl:Class>
    <owl:ObjectProperty rdf:ID="source">
    <rdfs:domain rdf:resource="#Information_Service"/>
    <rdfs:range rdf:resource="#InformationSource"/>
  </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="topic">
    <rdfs:domain rdf:resource="#Information_Service"/>
    <rdfs:range rdf:resource="&owl;#Thing"/>
  </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="information_date">
    <rdfs:domain rdf:resource="#Information_Service"/>
    <rdfs:range rdf:resource="&time;#TemporalEntity"/>
  </owl:ObjectProperty>
  <owl:Class rdf:ID="Banking_op">
    <rdfs:subClassOf rdf:resource="&profile;#Profile"/>
  </owl:Class>
  <owl:Class rdf:ID="Getinfo">
    <rdfs:subClassOf rdf:resource="#Banking_op"/>
  </owl:Class>
  <owl:Class rdf:ID="Getbalance">
    <rdfs:subClassOf rdf:resource="#GetInfo">
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="Getaccounts">
    <rdfs:subClassOf rdf:resource="#GetInfo"/>
  </owl:Class>
  <owl:Class rdf:ID="GetProducts">
    <rdfs:subClassOf rdf:resource="#GetInfo"/>
  </owl:Class>
  <owl:Class rdf:ID="GetServices">
    <rdfs:subClassOf rdf:resource="#GetInfo"/>
  </owl:Class>
  <owl:Class rdf:ID="GetPayments">
    <rdfs:subClassOf rdf:resource="#GetInfo"/>
  </owl:Class>
  <owl:Class rdf:ID="Getinvoices">
    <rdfs:subClassOf rdf:resource="#GetInfo"/>
  </owl:Class>
</rdf:RDF>
```

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