



Data, Information and Process Integration  
with Semantic Web Services

**DIP**

*Data, Information and Process Integration with Semantic Web Services*

**FP6 - 507483**

Deliverable

**WP10: Case study eBanking**

**D10.3**

**Financial Ontology**

Mónica Martínez Montes

José Luís Bas

Sergio Bellido

Oscar Corcho

Silvestre Losada

Richard Benjamins

Jesús Contreras

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## EXECUTIVE SUMMARY

This document describes the financial ontology that has been created for Bankinter for the first eBanking case study in DIP, which is described in the deliverable D10.2. This application consists of a mortgage simulation and comparison service.

The financial ontology consists of several ontologies at different levels of abstraction: services and products; and channels, users and currencies. All of them are described in section 4. The ontology does not aim at covering the whole financial domain but focuses mainly on modelling conceptually the mortgage domain (the first application to be developed in the workpackage). The ontology has been designed to be modular enough to allow refinements in the context of the current domain and extensions to other domains in the financial area.

We explain the reasons why it is difficult to build an ontology that covers the complete financial domain, including previous standardization experiences and business aspects.

The financial ontology has been developed following the Methontology methodology [4]. For the specification phase we have used a technique proposed in the context of the kick-off phase of the On-to-knowledge methodology [9], which has proven to be useful to obtain the initial set of concepts and relations, and their classification, from non-experts in knowledge representation.

This deliverable is especially relevant to workpackage 3.

## Document Information

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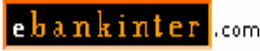



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<b>Authors (Partner)</b>	Mónica Martínez Montes, José Luís Bas, Sergio Bellido (Bankinter), Oscar Corcho, Silvestre Losada, Richard Benjamins, Jesús Contreras (iSOCO)			
<b>Responsible Author</b>	Mónica Martínez Montes	<b>Email</b>	<a href="mailto:mmtnez@bankinter.es">mmtnez@bankinter.es</a>	
	<b>Partner</b>	Fundación de la Innovación. Bankinter	<b>Phone</b>	

<b>Abstract (for dissemination)</b>	This document describes a financial ontology that has been developed for the first eBanking case study (mortgage simulator/comparator).
<b>Keywords</b>	Financial ontology, mortgage

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## Project Consortium Information

Partner	Acronym	Contact
National University of Ireland Galway	NUIG 	Prof. Dr. Christoph Bussler Digital Enterprise Research Institute (DERI) National University of Ireland, Galway Galway Ireland Email: <a href="mailto:chris.bussler@deri.org">chris.bussler@deri.org</a> Tel: +353 91 512460
Fundacion De La Innovacion.Bankinter	Bankinter 	Monica Martinez Montes Fundacion de la Innovacion. BankInter Paseo Castellana, 29 28046 Madrid, Spain Email: <a href="mailto:mmtnez@bankinter.es">mmtnez@bankinter.es</a> Tel: 916234238
Berlecon Research GmbH	Berlecon 	Dr. Thorsten Wichmann Berlecon Research GmbH Oranienburger Str. 32 10117 Berlin, Germany Email: <a href="mailto:tw@berlecon.de">tw@berlecon.de</a> Tel: +49 30 2852960
British Telecommunications Plc.	BT 	Dr John Davies BT Exact (Orion Floor 5 pp12) Adastral Park Martlesham Ipswich IP5 3RE, United Kingdom Email: <a href="mailto:john.nj.davies@bt.com">john.nj.davies@bt.com</a> Tel: +44 1473 609583
Swiss Federal Institute of Technology, Lausanne	EPFL 	Prof. Karl Aberer Distributed Information Systems Laboratory École Polytechnique Fédérale de Lausanne Bât. PSE-A 1015 Lausanne, Switzerland Email : <a href="mailto:Karl.Aberer@epfl.ch">Karl.Aberer@epfl.ch</a> Tel: +41 21 693 4679
Essex County Council	Essex 	Mary Rowlett, Essex County Council PO Box 11, County Hall, Duke Street Chelmsford, Essex, CM1 1LX United Kingdom. Email: <a href="mailto:maryr@essexcc.gov.uk">maryr@essexcc.gov.uk</a> Tel: +44 (0)1245 436524
Forschungszentrum Informatik	FZI 	Andreas Abecker Forschungszentrum Informatik Haid-und-Neu Strasse 10-14 76131 Karlsruhe Germany Email: <a href="mailto:abecker@fzi.de">abecker@fzi.de</a> Tel: +49 721 9654 0

Institut für Informatik, Leopold-Franzens Universität Innsbruck	UIBK 	Prof. Dieter Fensel Institute of computer science University of Innsbruck Technikerstr. 25 A-6020 Innsbruck, Austria Email: <a href="mailto:dieter.fensel@deri.org">dieter.fensel@deri.org</a> Tel: +43 512 5076485
ILOG SA	ILOG  Changing the rules of business	Christian de Sainte Marie 9 Rue de Verdun, 94253 Gentilly, France Email: <a href="mailto:cma@ilog.fr">cma@ilog.fr</a> Tel: +33 1 49082981
inubit AG	Inubit  the integration experts	Torsten Schmale inubit AG Lützowstraße 105-106 D-10785 Berlin Germany Email: <a href="mailto:ts@inubit.com">ts@inubit.com</a> Tel: +49 30726112 0
Intelligent Software Components, S.A.	iSOCO 	Dr. V. Richard Benjamins, Director R&D Intelligent Software Components, S.A. Pedro de Valdivia 10 28006 Madrid, Spain Email: <a href="mailto:rbenjamins@isoco.com">rbenjamins@isoco.com</a> Tel. +34 913 349 797
The Open University	OU 	Dr. John Domingue Knowledge Media Institute The Open University, Walton Hall Milton Keynes, MK7 6AA United Kingdom Email: <a href="mailto:j.b.domingue@open.ac.uk">j.b.domingue@open.ac.uk</a> Tel.: +44 1908 655014
SAP AG	SAP 	Dr. Elmar Dörner SAP Research, CEC Karlsruhe SAP AG Vincenz-Priessnitz-Str. 1 76131 Karlsruhe, Germany Email: <a href="mailto:elmar.dorner@sap.com">elmar.dorner@sap.com</a> Tel: +49 721 6902 31
Sirma AI Ltd.	Sirma  Ontotext Knowledge and Language Engineering Lab of Sirma	Atanas Kiryakov, Ontotext Lab, - Sirma AI EAD Office Express IT Centre, 3rd Floor 135 Tzarigradsko Chausse Sofia 1784, Bulgaria Email: <a href="mailto:atanas.kiryakov@sirma.bg">atanas.kiryakov@sirma.bg</a> Tel.: +359 2 9768 303
Tiscali Österreich GmbH	Tiscali 	Dieter Haacker Tiscali Österreich GmbH. Diefenbachgasse 35 A-1150 Vienna Austria Email: <a href="mailto:Dieter.Haacker@at.tiscali.com">Dieter.Haacker@at.tiscali.com</a>

		Tel: +43 1 899 33 160
Unicorn Solution Ltd.	Unicorn 	Jeff Eisenberg Unicorn Solutions Ltd, Malcha Technology Park 1 Jerusalem 96951 Israel Email: <a href="mailto:Jeff.Eisenberg@unicorn.com">Jeff.Eisenberg@unicorn.com</a> Tel.: +972 2 6491111
Vrije Universiteit Brussel	VUB 	Carlo Wouters Starlab- VUB Vrije Universiteit Brussel Pleinlaan 2, G-10 1050 Brussel ,Belgium Email: <a href="mailto:carlo.wouters@vub.ac.be">carlo.wouters@vub.ac.be</a> Tel.: +32 (0) 2 629 3719

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## 1 INTRODUCTION

The overall objective of WP10 in the DIP integrated project is the development of a case study in the ebanking domain. The case study selected as a result of deliverable D10.1 [2] is a Simulation tool for Mortgage Comparison.

The financial ontology described in this deliverable has been developed using Methontology [4], a methodology for ontology construction that has been recommended in DIP deliverable D3.3 for the development of the ontologies needed in all the workpackages.

It is beyond the scope of this deliverable and of the specific case study the creation of a complete financial ontology, deepening in all the possible branches of products and services offered by a bank. For this reason, we have focused on those parts of the ontology that are applicable to our specific case study, as follows:

- 1) We have considered all the cases that can be applied to mortgage processes, which are about the comparison and simulation of mortgages and with the internal procedure of approval of the mortgage.
- 2) We have established relationships between all the concepts available from the same point of view, with special attention to the possible combinations of information that a simulator/comparison tool can perform.

There are several reasons for which building an ontology that covers the whole financial domain is difficult:

- Standardisation efforts in the banking domain are very slow and several examples exist of unsuccessful attempts. For instance, we can cite the example of Mobipay in Spain, a micro-payments standardisation initiative, where different interests were involved and no effective market action was finally made.
- Innovation-oriented banks like Bankinter prefer creating innovative products on their own, so that they have some competitive advantage during a short period of time (usually around half a year) until the rest of banks implement such innovations too. That is, we strongly believe that a bank like Bankinter will adopt its own conceptual model and then, if successful, this model will be progressively adopted by other banks. This is well documented by a Forrester Research's business report [10], where the process of ontology adoption in business is explained.
- The financial domain is very dynamic: new products appear on a weekly basis and some of them cannot be categorised a priori.
- There is a high complexity in the current financial standards, such as IFX (International Financial eXchange Forum), and the agreement between different financial entities is difficult as well, as aforementioned.

There are also strong reasons to develop a new ontology (based on existing ontologies and standardisation initiatives) instead of directly reusing already existing ones:

- In a mature market, such as the financial one, the only advantage between competitors is the know-how and the technology approach. Therefore, proposals of standardisation usually result in long projects, as aforementioned. In these projects, the strongest banks usually impose their own criteria to the rest, whilst small banks try to find a way to make things slightly (or completely) different in order to

compete where the big ones cannot. In that frame, a descriptive but not-too-complex ontology makes the standardization process easier and faster. It also allows each Bank to model its own complexity while maintaining a certain degree of differentiation within a common framework.

- Most of the existing ontologies that we have studied model the financial domain from a client point of view, and do not cover sufficiently the internal processes that a bank must follow to deploy a mortgage contract.

The current version of the financial ontology is the result of the analysis and partial reuse of different knowledge sources in the financial domain: IFX<sup>1</sup> (Interactive Financial eXchange), existing mortgage comparison Web sites and heterogeneous mortgage information providers from a representative set of Spanish bank Web sites, and existing financial ontologies publicly available. From this analysis we have extracted the most representative concepts, unifying the different ways used to express them and removing duplicates. For instance, there are several bases that can be applied to calculate periodically the rates of mortgages at a variable rate. All of them have been grouped under the concept *ProductRateApplication*.

On the other hand we have tried to cover the most common cases of the European mortgage market, instead of covering all the cases and peculiarities that can occur in all the national markets.

Also, several specific products have been intentionally left apart due to its low market share. For instance, there are mortgages whose rates are related to specific balances in a saving account or to other financial products. These situations would have a negative influence in the complexity of the framework of this case study and with a small impact in the simulator results, hence losing our general focus.

## 2 ONTOLOGY BUILDING METHODOLOGIES

As described in the introduction of this deliverable, and as proposed by WP3, we have used Methontology [4] to develop the ontology. Methontology enables the construction of ontologies at the knowledge level and includes [1]: the identification of the ontology development process, a life cycle based on evolving prototypes, and particular techniques for carrying out each activity. Methontology is supported by ODE [1], [4] and WebODE, although other ontology tools can be used to create ontologies with it. In this case, Protégé-2000 [7] with its OWL plug-in [6] has been used. The editor created in the context of the DIP project will be used in the future, if the ontology needs to be modified or extended.

### 2.1 Ontology Development Process

The ontology development process [3] refers to *which* activities are carried out when building ontologies. It is crucial to identify these activities in order to reach agreement on ontologies that are to be built co-operatively by geographically distant teams, with some assurance of correctness and completeness. If this is the case, it is advisable to perform the three categories of activities presented below and steer clear of anarchic constructions (Figure 1).

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<sup>1</sup> <http://www.ifxforum.org/ifxforum.org/standards/index.cfm>

- **Project Management Activities** include planning, control and quality assurance. *Planning* identifies which tasks are to be performed, how they will be arranged, how much time and what resources are needed for their completion. This activity is essential for reusing ontologies which have already been built or for building ontologies that require different levels of abstraction and generalisation. *Control* guarantees that planned tasks are completed according to the way they were intended to be performed. Finally, *Quality Assurance*, assures that the quality of each and every product outputted (ontology, software and documentation) is satisfactory. [8] describes how these activities are performed.
- **Development-Oriented Activities** include specification, conceptualisation, formalisation and implementation. *Specification* states why the ontology is being built, what are its intended uses and who are the end-users. *Conceptualisation* structures the domain knowledge as meaningful models at the knowledge level. *Formalisation* transforms the conceptual model into a formal or semi-computable model. *Implementation* builds computable models in a computational language. Finally, *Maintenance* updates and corrects the ontology. [4] gives details of how all the development activities, except Formalisation and Maintenance, are performed.
- **Support Activities** include a series of activities, performed at the same time as development-oriented activities, without which no ontology could be built. They include knowledge acquisition, evaluation, integration, documentation and configuration management. *Knowledge Acquisition* acquires knowledge of a given domain. *Evaluation* makes a technical judgement of the ontologies, their associated software environments and documentation with respect to a frame of reference during each phase and between phases of their life cycle [5]. *Integration* of ontologies is required when building a new ontology reusing other ontologies that are already available. *Documentation* details, clearly and exhaustively, each and every one of the phases completed and products generated. *Configuration Management* records all the versions of the documentation, software and ontology code to control the changes. In [4], [5], a description is given of how Knowledge Acquisition was performed in the CHEMICALS ontology (an ontology about chemical elements and their properties), and Evaluation, Integration and Configuration Management is discussed in [6], where the documentation produced is discussed as part of the description of each activity.

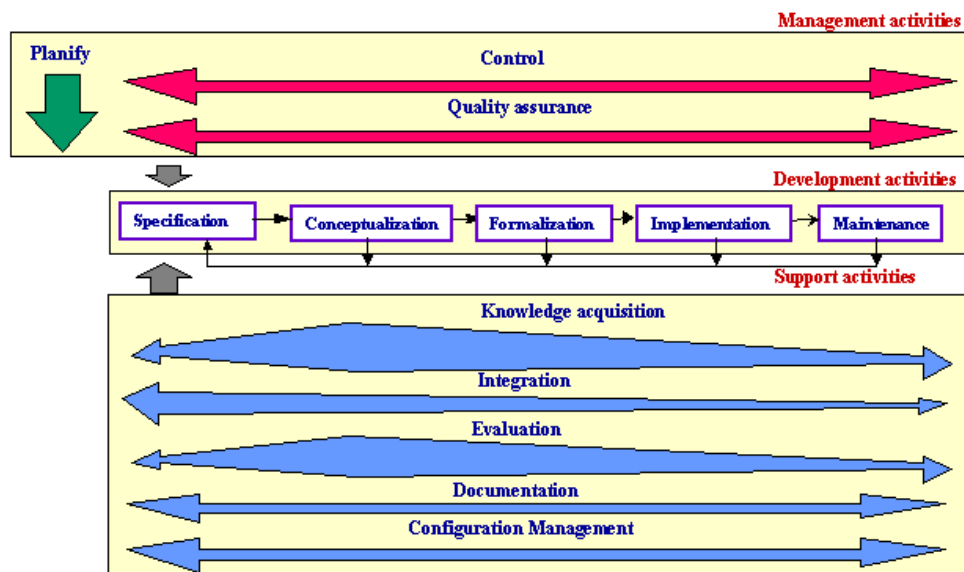


Figure 1. Methontology development process (adapted from [3]).

## 2.2 Ontology Life Cycle

It identifies the *set of stages* through which the ontology moves during its lifetime, describes what activities are to be performed in each stage and how the stages are related (relation of precedence, return, etc.). In [3], a justification is given of why the ontology life cycle should be based on evolving prototypes. For each prototype, Methontology proposes to begin with the *specification* of the ontology. Simultaneously with this phase, the knowledge acquisition activity starts. Once the first prototype has been specified, the construction of the conceptual model is built at the *conceptualisation* phase. It is like assembling a jigsaw puzzle from the pieces supplied by the knowledge acquisition activity. The puzzle is completed during the conceptualisation stage [4]. After the conceptualisation, *formalisation* and *implementation* of knowledge are carried out.

Formalisation is not a mandatory activity, because using ontology tools the conceptualisation model is usually automatically implemented with translators to ontology languages.

Control, quality assurance, integration, evaluation, documentation, and configuration management are carried out simultaneously to the development activities. However, the stage where the effort for doing integration and evaluation is bigger is the conceptualisation one.

## 3 DEVELOPMENT OF THE FINANCIAL ONTOLOGY

### 3.1 Specification. Goal and scope of the ontology

In the ontology specification phase we have used the techniques proposed for the kick-off phase of the On-To-Knowledge methodology [9], which consist in obtaining the first list of concepts and relations by means of brainstorming sessions with domain experts and by using supporting tools like MindManager® or similar. Figure 2 presents the type of result of this phase, which consists of a conceptual map with suggestions of how to classify the relevant concepts and relations.



### 3.2 Knowledge sources

Several knowledge sources have been used during the knowledge acquisition phase of the ontology development process. The objective of using several sources was to create an ontology that could be adopted, in the future, by as many other organisations as possible, although this is not a strong requirement. The knowledge sources used are the following:

- Interactive Financial eXchange (IFX), which is an XML-based, financial messaging protocol, built by financial industry and technology leaders, designed for interoperability of systems seeking to exchange financial information internally and externally.
- Aggregated mortgage information provided by <http://www.comparador.com/>.
- Mortgage information publicly provided by the Web sites of 12 Spanish banks, including the most important ones with respect to the mortgage market<sup>2</sup>, which are: BBVA<sup>3</sup>, BSCH<sup>4</sup>, Caja Madrid, La Caixa<sup>5</sup>, Banco Popular<sup>6</sup>, iBanesto<sup>7</sup>, Patagon<sup>8</sup>, Bankinter<sup>9</sup>, Banco Pastor<sup>10</sup>, Banco Sabadell, and BBK. Annex I provides information about the process followed to obtain this information.
- A financial ontology<sup>11</sup> developed by Teknowledge and written in KIF. The ontology extends the SUMO upper-level ontology and provides some top-level terms in the financial domain.

As a result of the knowledge acquisition process, the most important terms of all the knowledge sources were identified, as well as their commonalities and differences.

## 4 CONCEPTUALIZATION

In this section we present the conceptualisation of the ontology according to the intermediate representations proposed by Methontology for this conceptualisation phase.

### 4.1 Knowledge Architecture

The financial ontology is composed of several ontologies at different levels of abstraction: services and products, channels, users, and currencies. In the following sections we provide the details of these ontologies.

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<sup>2</sup> An unofficial ranking of Spanish banks with respect to their position on the mortgage market is available at: [http://www.euroresidentes.com/vivienda/hipotecas/entidades\\_que\\_le\\_dan\\_la\\_hipoteca.htm](http://www.euroresidentes.com/vivienda/hipotecas/entidades_que_le_dan_la_hipoteca.htm)

<sup>3</sup> <http://www.bbva.es/TLBS/tlbs/jsp/esp/pusted/proderv/hipotecas/hipotecacuotafinal.jsp?Pestana=Haga%20n%FAmeros>

<sup>4</sup> [https://www.gruposantander.com/SimH\\_SCH/portada.jsp?login=particular&password=particular](https://www.gruposantander.com/SimH_SCH/portada.jsp?login=particular&password=particular)

<sup>5</sup> [http://portal1.lacaixa.es/Channel/Ch\\_Redirect\\_Tx?dest=1-12-10-00000101](http://portal1.lacaixa.es/Channel/Ch_Redirect_Tx?dest=1-12-10-00000101)

<sup>6</sup> <http://www.bancopopular.es/simuladores/simula.asp>

<sup>7</sup> <http://www.ibanesto.com>

<sup>8</sup> <https://bancaonline.patagon.es/servlet/PProxy?app=DJ&cmd=8009&active=0&opcion=BC>

<sup>9</sup> [https://www.ebankinter.com/www/es-es/cgi/ebk+hip+compra\\_venta](https://www.ebankinter.com/www/es-es/cgi/ebk+hip+compra_venta)

<sup>10</sup> [http://www.bancopastor.es/d30/d3020/3020\\_stage2.html](http://www.bancopastor.es/d30/d3020/3020_stage2.html)

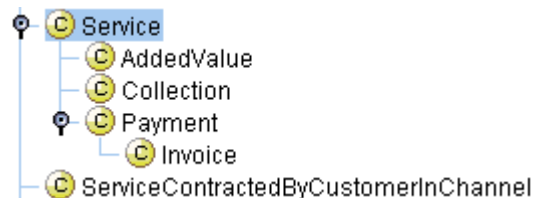
<sup>11</sup> <http://einstein.teknowledge.com:8080/download/register.jsp?fileType=.tar&fileName=FinancialOnt.tar>

## 4.2 Ontology conceptualisation: Service ontology

### Terms glossary

Name	Description	Type
Service	Financial product offered by a bank or services that does not require a contract, like a bank transfer order	Concept
AddedValue	Bank service. The sales revenue from selling a product less the cost of the materials or purchases used in those products. It is an indicator of relative efficiency within and between firms, although in the latter case it is open to distortion where mark-up varies between standard and premium-priced segments of a market	Concept
Collection	Bank service. Deposit in a saving account	Concept
Payment	Bank service. Money given to pay for something	Concept
Invoice	An itemized statement given to a buyer by a seller and usually specifying the price of goods or services and the terms of sale	Concept
ServiceContractedByCustomerInChannel	Product or service contracted by a channel	Concept
service ( <i>ServicesContractedByCustomerInChannel, Service</i> )	Service contracted	Relation
channel ( <i>ServicesContractedByCustomerInChannel, Channel</i> )	Channel where the contract has taken place	Relation
customer ( <i>ServicesContractedByCustomerInChannel, Customer</i> )	Customer that has contracted a service	Relation

### Concept classification tree



### Concept dictionary

Concept name	Class attributes	Instance attributes	Relations
Service	--	--	--
AddedValue	--	--	--
Collection	--	--	--
Payment	--	--	--
Invoice	--	--	--
ServiceContractedByCustomerInChannel	--	--	service channel customer

### Binary relation table

Relation name	Source concept	Source cardinality (Max)	Target concept
service	ServicesContractedByCustomerInChannel	n	Service
channel	ServicesContractedByCustomerInChannel	n	Channel
customer	ServicesContractedByCustomerInChannel	n	Customer

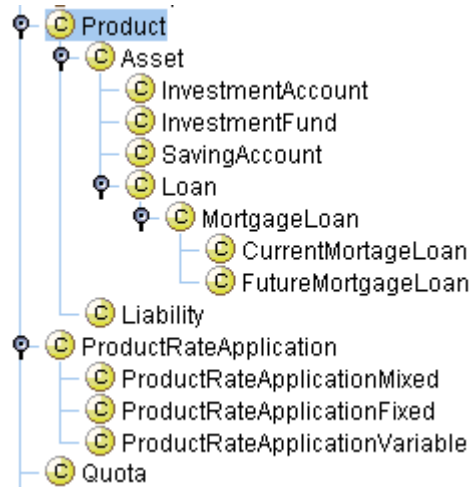
## 4.3 Ontology conceptualisation: Product ontology

### Terms glossary

Name	Description	Type
Product	Bank product that requires the signature of a contract between the customer and the bank	Concept
Asset	The land or property of a company or individual, payments due from bills, investments, and anything else owned that can be turned into cash	Concept
InvestmentAccount	Account setup to perform an investment, such as a fixed term deposit	Concept
InvestmentFund	Investment club where a set of customers put their money so that the bank performs an investment on behalf of them.	Concept
SavingAccount	Account without a chequebook and normally with a low interest rate	Concept
Loan	Money let out at interest	Concept
MortgageLoan	A long-term loan backed by real estate or valuable property, usually the item purchased with the loan. The creditor can claim that property if all payments are not made by the borrower when they are due	Concept
CurrentMortgageLoan	Current mortgage loan that the user is willing to change.	Concept
FutureMortgageLoan	Future mortgage loan that the user will use instead of the current one	Concept
Liability	The amount that is owed by an individual or company, whether money, products, or services, to others.	Concept
ProductRateApplication	Applied interest rate	Concept
ProductRateApplicationMixed	Mixed interest rate, usually composed of fixed and variable interest rates	Concept
ProductRateApplicationFixed	Fixed interest rate. It never varies during the mortgage life	Concept
ProductRateApplicationVariable	Variable interest rate. It may vary during the mortgage life	Concept
Quota	Amount to be paid in a loan	Concept
cancelationCommission	Commission to be paid when a mortgage is cancelled	Relation
openingCommission	Commission to be paid when a mortgage is opened	Relation
subrogationCommission	Commission to be paid when a mortgage is subrogated	Relation
currencyProduct	Currency of a bank product	Relation

Name	Description	Type
interestRateType	Type of interest rate of a bank product	Relation
payments	Payments due in a saving account	Relation
handlingCapital		Instance Attribute
interestNextRevision	Interest Rate that will be effective in the next period.	Instance Attribute
saleCostProperty	Sale cost from the building to which reference the mortgage	Instance Attribute
buyCostProperty	Buy cost from the building to which reference the mortgage	Instance Attribute
quotaAfterRevision	Monthly payment that will pay after the revision of the interest rate.	Instance Attribute
delayInterestRate	Interest rate that will be applied in case of delay in the payment.	Instance Attribute
homeInsurance	It indicates if it's necessary contract a home insurance.	Instance Attribute
initalQuota	Monthly payment that will pay at the beginning.	Instance Attribute
initialPeriod	Period that customer will pay the inical quota	Instance Attribute
lifeInsurance	It indicates if it's necessary contract a life insurance	Instance Attribute
mortagageTaxation	Value of the property. This value has been specified by an expert.	Instance Attribute
periodicityQuota	Regularity of the monthly payment, annual payments etc	Instance Attribute
revisionTerm	Term between two revisions of the type of interest	Instance Attribute
term	Trem payment.	Instance Attribute
interestRateValue	Interest rate of financial product.	Instance Attribute
capital	Total capital of the mortgage.	Instance Attribute
APR	The annual percentage rate (APR) is an interest rate that includes other commissions.	Instance Attribute
expirationDate	Expirtion date for mortgage	Instance Attribute
signalDateContract	Intial date of mortgage.	Instance Attribute

### Concept classification tree



### Concept dictionary

Concept name	Class attributes	Instance attributes	Relations
Product	--	APR expirationDate signalDateContract interestRateValue	currencyProduct interestRateType
Asset	--	--	--
InvestmentAccount	--	--	--
InvestmentFund	--	--	--
SavingAccount	--	--	payments
Loan	--	--	--
MortgageLoan	--	revisionTermNext capital	--
CurrentMortgageLoan	--	handlingCapital interestNextRevision saleCostProperty	cancelationCommission
FutureMortgageLoan	--	buyCostProperty quotaAfterRevision delayInterestRate homeInsurance initalQuota initialPeriod interesDelay lifeInsurance mortgageTaxation periodicityQuota revisionTerm term	openingCommission subrotationCommission
Liability	--	--	--
ProductRateApplication	--	interestRateValue	--
ProductRateApplicationMixed	--	termRateFixed	--

Concept name	Class attributes	Instance attributes	Relations
ProductRateApplicationFixed	--	--	--
ProductRateApplicationVariable	--	--	--
Quota	--	endingDate startingDate	--

### Binary relation table

Relation name	Source concept	Source cardinality (Max)	Target concept
cancelationCommission	CurrentMortgageLoan	1	Quota
openingCommission	FutureMortgageLoan	1	Quota
subrogationCommission	FutureMortgageLoan	1	Quota
currencyProduct	Product	1	Currency
interestRateType	Product	n	ProductRateApplication
payments	SavingAccount	n	Payment

### Instance attribute table

Instance attribute name	Concept name	Value type	Cardinality
handlingCapital	CurrentMortgageLoan	String	(0, n)
interestNextRevision	CurrentMortgageLoan	String	(0, n)
saleCostProperty	CurrentMortgageLoan	String	(0, n)
buyCostProperty	FutureMortgageLoan	String	(0, n)
quotaAfterRevision	FutureMortgageLoan	String	(0, n)
delayInterestRate	FutureMortgageLoan	String	(0, n)
homeInsurance	FutureMortgageLoan	String	(0, n)
initalQuota	FutureMortgageLoan	String	(0, n)
initialPeriod	FutureMortgageLoan	String	(0, n)
interesDelay	FutureMortgageLoan	String	(0, n)
lifeInsurance	FutureMortgageLoan	String	(0, n)
mortgageTaxation	FutureMortgageLoan	String	(0, n)
periodicityQuota	FutureMortgageLoan	String	(0, n)
revisionTerm	FutureMortgageLoan	String	(0, n)
term	FutureMortgageLoan	String	(0, n)
interestRateValue	Product, ProductRateApplication	String	(0, n)
revisionTermNext	MortgageLoan	String	(0, n)

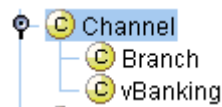
Instance attribute name	Concept name	Value type	Cardinality
capital	MortgageLoan	String	(0, n)
APR	Product	String	(0, 1)
expirationDate	Product	String	(0, n)
signalDateContract	Product	String	(0, n)
termRateFixed	ProductRateApplicationMixed	String	(0, 1)
endingDate	Quota	String	(0, n)
startingDate	Quota	String	(0, n)

#### 4.4 Ontology conceptualisation: Channel ontology

##### Terms glossary

Name	Description	Type
Channel	Communication means used in the relationship between the bank and its customers, including branches, phone, Internet, virtual banking, etc.	Concept
Branch	Physical bank office	Concept
vBanking	Virtual Banking. Banking without human intervention	Concept

##### Concept classification tree



##### Concept dictionary

Concept name	Class attributes	Instance attributes	Relations
Channel	--	--	--
Branch	--	--	--
vBanking	--	--	--

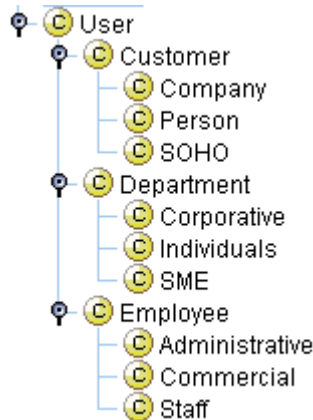
#### 4.5 Ontology conceptualisation: User ontology

##### Terms glossary

Name	Description	Type
User	Any user of the system: customers, departments, and employees	Concept
Customer	Bank client, who usually has a contractual relationship with the bank	Concept
Company	A number of people grouped together as a business enterprise. Types of companies include public limited companies, partnerships, joint ventures and proprietorships, and branches of foreign companies	Concept
Person	Bank client that represents a single person (physical or juridical)	Concept
SOHO	Small Office, Home Office. It usually refers to professionals who work in their own offices	Concept

Name	Description	Type
Department	Internal area of the bank that performs a specific function	Concept
Corporative	Company with a specific set of characteristics that require a personalised commercial treatment. Depending on each bank, the set of characteristics may change, although they normally refer to number of employees and annual turnover. It includes company groups, multinational companies, etc.	Concept
Individual	Department that deals with physical persons	Concept
SME	Small or Medium Enterprise	Concept
Employee	Employee	Concept
Administrative	Employee with administrative functions	Concept
Commercial	Employee with commercial functions	Concept
Staff	Central Services of a company, such as Human Resources, Management, Innovation, etc.	Concept
titularity	Product that a customer holds	Relation
login	User login	Instance Attribute
password	User password	Instance Attribute
name	Product or customer name	Instance Attribute
CIF	Código de Identificación Fiscal	Instance Attribute
NIF	Número de Identificación Fiscal	Instance Attribute

### Concept classification tree



### Concept dictionary

Concept name	Class attributes	Instance attributes	Relations
User	--	login password	--
Customer	--	name	titularity

Company	--	CIF	--
Person	--	NIF	--
SOHO	--	NIF	--
Department	--	--	--
Corporative	--	--	--
Individuals	--	--	--
SME	--	--	--
Employee	--	--	--
Administrative	--	--	--
Commercial	--	--	--
Staff	--	--	--

### Binary relation table

Relation name	Source concept	Source cardinality (max)	Target concept
titularity	Customer	N	Product

### Instance attribute table

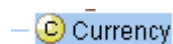
Instance attribute name	Concept name	Value type	Cardinality
login	User	String	1..1
password	User	String	1..1
name	Customer	String	1..1
NIF	Company	String	1..1
CIF	Person, SOHO	String	1..1

## 4.6 Ontology conceptualisation: Currency ontology

### Terms glossary

Name	Description	Type
Currency	Money in circulation	Concept

### Concept classification tree



### Concept dictionary

Concept name	Class attributes	Instance attributes	Relations
Currency	--	--	--

## 5 IMPLEMENTATION

The financial ontology has been implemented in OWL, since it has been modelled with the Protégé tool<sup>12</sup> and the OWL plug-in [6]. It has been transformed later into WSML, so that it can be used by the DIP architecture components. The source code in both languages is available in the DIP BSCW server<sup>13</sup>.

## 6 REFERENCES

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- [9] Staab S, Schnurr HP, Studer R, Sure Y (2001) Knowledge Processes and Ontologies. IEEE Intelligent Systems 16(1):26-34
- [10] How the X Internet will Communicate. Forrester Research. Available at <http://www.forrester.com/ER/Research/Report/Summary/0,1338,13387,00.html>

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<sup>12</sup> <http://protege.stanford.edu/>

<sup>13</sup> <https://bscw.dip.deri.ie/>

## ANNEX I. ANALYSIS OF WEB MORTGAGE SIMULATORS

As shown in section 3.2, we have used a set of 12 mortgage simulators as a knowledge source for the financial ontology. These simulators are mainly offered by financial institutions, although other non-financial Web sites are also available with the same kind of information.

The institutions analysed have usually more than one simulator, varying from 1 to almost 20, due to the following reasons:

- In several cases, each type of mortgage has its own simulator.
- In most of the cases, there are one or several commission simulators.
- In most of the cases, there are tax simulators.
- In several cases, the actual interest type is provided by the institution, while in others, the simulator requires the client to specify it.
- In several cases, the cost of the property to be bought is required, in others the Public Registry value is required, and in a few cases, no value has to be provided.

Hence, we really analysed more than 70 simulators from 12 financial institutions.

In a first approach, we identified an extensive list of concepts used as inputs and outputs by at least one of the mentioned simulators.

INPUT DATA	OUTPUT DATA
Importe del prestamo	Cuota actual
Plazo del prestamo	Limite de prestamo recomendado
Tipo de interes estimado	Gastos totales compra/venta e hipoteca del inmueble.
Ingresos netos anuales un. familiar	Valor maximo del inmueble a comprar
Gastos anuales un. familiar	Cuota estimada tras revision
Valor compra inmueble	Comision de apertura y/o estudio
Tipo inmueble (Nueva/usada)	Impuestos compra inmueble
Comunidad Autonoma	Notario compra inmueble
Vendedor inmueble	Gestoria compra inmueble
Ahorro estimado destinado a la compra	Tasacion compra inmueble
Importe venta inmueble actual	Impuestos Hipoteca
Inversiones en reformas, etc	Notario Hipoteca
Gastos compra/venta e hipoteca del inmueble	Gestoria hipoteca
Tipo interes prestamo actual	Diferencia mensual con otra entidad comparada
Plazo hasta proxima revision prestamo actual	Diferencia anual con otra entidad comparada

INPUT DATA	OUTPUT DATA
Tipo intereses estimado proxima revision prestamo actual	Diferencia total con otra entidad comparada
Importe prestamo actual	Notaría cancelación prestamo actual
Porcentaje s/cuota final	Gestoria cancelacion prestamo actual
Tipo de interes inicial	Registro cancelacion prestamo actual
Duracion periodo inicial	Plazo amortizacion hipoteca
Valor tasacion inmueble a comprar	Cuota con seguro vida
Tipo: fija, variable, mixta, autopromotor	Cuota con seguro hogar
Indice de referencia (Euribor. irph)	Cuota con ambos seguros
Importe prestamo sobre total valor compra	
Numero miembros unidad familiar	
Tipo trabajo (Cuenta ajena, autonomo, ambos)	
Tipo contrato (fijo, mensual)	
Antiguedad en el empleo (fijo/temporal)	
Primera hipoteca (si/no)	
Cuota inicial	
Comprobacion registral	
Provincia vivienda nueva	
Comision apertura	
Periodicidad de la cuota (mensual, trimestral, semestral, anual, 14 cuotas al año)	
Pesetas/euros	
Tipo de interes aplicable en otra entidad	
Comision de cancelacion prestamo actual	
Seguro de vida	
Seguro de hogar	
Ambos seguros	
Sin seguros	

Then we proceeded with the filtering of the results. We identified that several inputs were used in just one simulator or for a very specific type of mortgage. Some of the inputs that were filtered are the following:

- Ingresos netos anuales un. Familiar
- Gastos anuales un familiar
- Tipo inmueble (Nueva/usada)
- Vendedor inmueble (persona física o jurídica)

- 
- Ahorro estimado que posee el solicitante destinado a la compra
  - Numero miembros unidad familiar
  - Tipo trabajo (Cuenta ajena, autónomo, ambos)
  - Tipo contrato (fijo, mensual)
  - Antigüedad en el empleo (fijo/temporal)
  - Primera hipoteca (si/no)
  - Comprobación registral
  - Provincia vivienda nueva
  - Tipo de interés aplicable en otra entidad

Some of the outputs that were filtered are the following:

- Tasación compra inmueble
- Notaría: cancelación préstamo actual
- Gestoría: cancelaciónn préstamo actual
- Registro: cancelación préstamo actual

The second filter was to identify which of the input and output terms could be unified in a common concept. For example we identified that 'Plazo del préstamo' and 'Plazo de amortización de hipoteca' referred to the same entity in more than 90% of the cases.

The third step was to define the meaning of each concept, taking into account its main use in most of the simulators. Then, we decided which terms should be considered as concepts, which ones should be considered as concept properties or relations, etc., and we obtained the mind map shown in figure 2.

**ANNEX II. FINANCIAL ONTOLOGY IN OWL**

```

<?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:xsd="http://www.w3.org/2001/XMLSchema#"
  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#"
  xmlns="http://users.isoco.net/~slosada/swws/bank.owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  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="Quota">
    <rdfs:comment xml:lang="en">Amount to be paid in a loan</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="InvestmentAccount">
    <rdfs:comment xml:lang="en">Account setup to perform an investment, such as a
    fixed term deposit</rdfs:comment>
    <rdfs:comment xml:lang="es">Cuenta de inversión. Por ejemplo una imposición a
    plazo fijo (IPF) o un depósito remunerado</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#Asset"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="ProductRateApplicationVariable">
    <owl:disjointWith>
      <owl:Class rdf:about="#ProductRateApplicationFixed"/>
    </owl:disjointWith>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#ProductRateApplication"/>
    </rdfs:subClassOf>
  </owl:Class>

```

---

```

<owl:disjointWith>
  <owl:Class rdf:about="#ProductRateApplicationMixed"/>
</owl:disjointWith>

  <rdfs:comment xml:lang="es">tipo de interés variable. Es un tipo de interés que se
  modifica periódicamente en función de los tipos de interés de mercado que se hayan
  predefinido en contrato</rdfs:comment>

  <rdfs:comment xml:lang="en">Variable interest rate. It may vary during the
  mortgage life</rdfs:comment>
</owl:Class>

<owl:Class rdf:ID="User"/>

<owl:Class rdf:ID="ServiceContractedByCustomerInChannel">
  <rdfs:comment xml:lang="en">Product or service contracted by a
  channel</rdfs:comment>
  <rdfs:comment xml:lang="es">Productos contratados por un canal</rdfs:comment>
</owl:Class>

<owl:Class rdf:ID="Customer">
  <rdfs:comment xml:lang="en">Bank client, who usually has a contractual
  relationship with the bank</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#User"/>
  <rdfs:comment xml:lang="es">Cliente que mantiene una relación contractual con el
  banco (normalmente una cuenta bancaria)</rdfs:comment>
</owl:Class>

<owl:Class rdf:ID="ProductRateApplicationMixed">
  <owl:disjointWith>
    <owl:Class rdf:about="#ProductRateApplicationFixed"/>
  </owl:disjointWith>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#ProductRateApplication"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Mixed interest rate, usually composed of fixed and
  variable interest rates</rdfs:comment>
  <rdfs:comment xml:lang="es">tipo de interés mixto. Es una mezcla de tipo fijo y
  variable. Normalmente fijo en las primeras cuotas y variable en las
  demás</rdfs:comment>
  <owl:disjointWith rdf:resource="#ProductRateApplicationVariable"/>
</owl:Class>

<owl:Class rdf:ID="FutureMortgageLoan">

```

---

```
<rdfs:comment xml:lang="es">Préstamo hipotecario por el que el usuario está pensando cambiar su préstamo actual</rdfs:comment>
<rdfs:comment xml:lang="en">Future mortgage loan that the user will use instead of the current one</rdfs:comment>
<rdfs:subClassOf>
  <owl:Class rdf:about="#MortgageLoan"/>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Collection">
  <rdfs:comment xml:lang="es">Ingreso en cuenta</rdfs:comment>
  <rdfs:comment xml:lang="en">Deposit in a saving account</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Service"/>
  </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:comment xml:lang="es">Small Office, Home Office. Normalmente se refiere a profesionales que trabajan en su propio despacho o negocio</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#Customer"/>
  <rdfs:comment xml:lang="en">Small Office, Home Office. It usually refers to professionals who work in their own offices</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Loan">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Asset"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Money let out at interest</rdfs:comment>
  <rdfs:comment xml:lang="es">Préstamo, crédito, cualquier cuenta con saldo a favor del banco</rdfs:comment>
</owl:Class>
```

---

```

<owl:Class rdf:ID="Branch">
  <rdfs:comment xml:lang="es">Oficina bancaria fisica</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Channel"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Physical bank office</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Staff">
  <rdfs:comment xml:lang="es">Servicios Centrales de una empresa. Por ejemplo:
Recursos humanos, Alta dirección, Inmuebles y Servicios Generales, Innovación,
etc</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Employee"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Central Services of a company, such as Human
Resources, Management, Innovation, etc.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Person">
  <rdfs:comment xml:lang="es">Persona física o jurídica</rdfs:comment>
  <owl:disjointWith>
    <owl:Class rdf:about="#Company"/>
  </owl:disjointWith>
  <rdfs:subClassOf rdf:resource="#Customer"/>
  <rdfs:comment xml:lang="en">Bank client that represents a single person (physical
or juridical)</rdfs:comment>
  <owl:disjointWith rdf:resource="#SOHO"/>
</owl:Class>
<owl:Class rdf:ID="vBanking">
  <rdfs:comment xml:lang="es">Virtual Banking Banca por medios físicos o sin
intermediación humana.</rdfs:comment>
  <rdfs:comment xml:lang="en">Virtual Banking. Banking without human
intervention</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Channel"/>
  </rdfs:subClassOf>
</owl:Class>

```

```

<owl:Class rdf:ID="Currency">
  <rdfs:comment xml:lang="es">Divisa, incluyendo la moneda
nacional</rdfs:comment>
  <rdfs:comment xml:lang="en">Money in circulation</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Company">
  <owl:disjointWith rdf:resource="#Person"/>
  <owl:disjointWith rdf:resource="#SOHO"/>
  <rdfs:comment xml:lang="en">A number of people grouped together as a business
enterprise. Types of companies include public limited companies, partnerships, joint
ventures and proprietorships, and branches of foreign companies</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#Customer"/>
</owl:Class>
<owl:Class rdf:ID="Commercial">
  <rdfs:comment xml:lang="es">Empleado con funciones
comerciales</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Employee"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Employee with commercial
functions</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="ProductRateApplication">
  <rdfs:comment xml:lang="es">Tipo de interés aplicado</rdfs:comment>
  <rdfs:comment xml:lang="en">Applied interest rate</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="CurrentMortgageLoan">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#MortgageLoan"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="es">Préstamo hipotecario actual que el usuario está
pensando en cambiar</rdfs:comment>
  <rdfs:comment xml:lang="en">Current mortgage loan that the user is willing to
change.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="AddedValue">

```

<rdfs:comment xml:lang="en">The sales revenue from selling a product less the cost of the materials or purchases used in those products. It is an indicator of relative efficiency within and between firms, although in the latter case it is open to distortion where mark-up varies between standard and premium-priced segments of a market</rdfs:comment>

<rdfs:comment xml:lang="es">Es el valor con que enriqueces algo al transformarlo. Normalmente se calcula como la diferencia entre el valor de compra y el valor de venta, aunque es algo más intangible</rdfs:comment>

```

<rdfs:subClassOf>
  <owl:Class rdf:about="#Service"/>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="SME">
  <rdfs:comment xml:lang="es">Pequeña y Mediana Empresa (PYME)</rdfs:comment>
  <rdfs:comment xml:lang="en">Small or Medium Enterprise</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Department"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Individuals">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Department"/>
  </rdfs:subClassOf>
  <rdfs:comment xml:lang="en">Department that deals with physical persons</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Employee">
  <rdfs:subClassOf rdf:resource="#User"/>
</owl:Class>
<owl:Class rdf:ID="Asset">
  <rdfs:comment xml:lang="es">Activo bancario. Cuenta con saldo a favor del cliente.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Product"/>
  </rdfs:subClassOf>

```

---

```
<rdfs:comment xml:lang="en">The land or property of a company or individual,
payments due from bills, investments, and anything else owned that can be turned into
cash</rdfs:comment>
```

```
</owl:Class>
```

```
<owl:Class rdf:ID="Payment">
```

```
<rdfs:subClassOf>
```

```
<owl:Class rdf:about="#Service"/>
```

```
</rdfs:subClassOf>
```

```
<rdfs:comment xml:lang="en">Money given to pay for something</rdfs:comment>
```

```
<rdfs:comment xml:lang="es">Pago</rdfs:comment>
```

```
</owl:Class>
```

```
<owl:Class rdf:ID="InvestmentFund">
```

```
<rdfs:comment xml:lang="en">Investment club where a set of customers put their
money so that the bank performs an investment on behalf of them.</rdfs:comment>
```

```
<rdfs:comment xml:lang="es">Fondo de Inversión. Club de inversión donde muchas
personas ponen un dinero que el Banco invierte en su nombre y cuyos
beneficios/pérdidas se reinvierten. Es disponible en cualquier momento vendiendo las
participaciones que en su día se compraron.</rdfs:comment>
```

```
<rdfs:subClassOf rdf:resource="#Asset"/>
```

```
</owl:Class>
```

```
<owl:Class rdf:ID="Channel">
```

```
<rdfs:comment xml:lang="es">Canal de relación entre el cliente y el banco. Es el
medio que utiliza el cliente o el Banco para comunicarse: Oficinas, Internet, Banca
Telefónica, Teléfono móvil, Agentes, Oficinas Virtuales, etc.</rdfs:comment>
```

```
<rdfs:comment xml:lang="en">Communication means used in the relationship
between the bank and its customers, including branches, phone, Internet, virtual
banking, etc.</rdfs:comment>
```

```
</owl:Class>
```

```
<owl:Class rdf:ID="Corporate">
```

```
<rdfs:comment xml:lang="en">Company with a specific set of characteristics that
require a personalised commercial treatment. Depending on each bank, the set of
characteristics may change, although they normally refer to number of employees and
annual turnover. It includes company groups, multinational companies,
etc.</rdfs:comment>
```

```
<rdfs:subClassOf>
```

```
<owl:Class rdf:about="#Department"/>
```

```
</rdfs:subClassOf>
```

```
<rdfs:comment xml:lang="es">Empresa que por sus características merece un
tratamiento comercial individualizado. Dependiendo de cada Banco estas características
```

pueden variar, aunque normalmente se refieren a número de empleados y/o facturación anual. Incluye grupos de empresas, multinacionales, etc</rdfs:comment>

</owl:Class>

<owl:Class rdf:ID="Liability">

<rdfs:subClassOf>

<owl:Class rdf:about="#Product"/>

</rdfs:subClassOf>

<rdfs:comment xml:lang="en">The amount that is owed by an individual or company, whether money, products, or services, to others.</rdfs:comment>

<rdfs:comment xml:lang="es">Cantidad que un individuo o compañía debe a otros. Esta cantidad puede ser dinero, productos o servicios</rdfs:comment>

</owl:Class>

<owl:Class rdf:ID="Invoice">

<rdfs:comment xml:lang="es">Factura</rdfs:comment>

<rdfs:subClassOf rdf:resource="#Payment"/>

<rdfs:comment xml:lang="en">An itemized statement given to a buyer by a seller and usually specifying the price of goods or services and the terms of sale</rdfs:comment>

</owl:Class>

<owl:Class rdf:ID="ProductRateApplicationFixed">

<rdfs:comment xml:lang="en">Fixed interest rate. It never varies during the mortgage life</rdfs:comment>

<owl:disjointWith rdf:resource="#ProductRateApplicationMixed"/>

<rdfs:comment xml:lang="es">tipo de interés fijo. Es un tipo de interés que no cambia en toda la vida del préstamo.</rdfs:comment>

<owl:disjointWith rdf:resource="#ProductRateApplicationVariable"/>

<rdfs:subClassOf rdf:resource="#ProductRateApplication"/>

</owl:Class>

<owl:Class rdf:ID="Administrative">

<rdfs:comment xml:lang="en">Employee with administrative functions</rdfs:comment>

<rdfs:comment xml:lang="es">Empleado con funciones de administración.</rdfs:comment>

<rdfs:subClassOf rdf:resource="#Employee"/>

</owl:Class>

<owl:Class rdf:ID="MortgageLoan">

<rdfs:comment xml:lang="en">A long-term loan backed by real estate or valuable property, usually the item purchased with the loan. The creditor can claim that property if all payments are not made by the borrower when they are due</rdfs:comment>

<rdfs:comment xml:lang="es">Préstamo hipotecario</rdfs:comment>

<rdfs:subClassOf rdf:resource="#Loan"/>

</owl:Class>

<owl:Class rdf:ID="SavingAccount">

<rdfs:subClassOf rdf:resource="#Asset"/>

<rdfs:comment xml:lang="en">Account without a chequebook and normally with a low interest rate</rdfs:comment>

<rdfs:comment xml:lang="es">Cuenta de Ahorro. Es lo mismo que una cuenta corriente, pero con libreta y sin talonario de cheques. Normalmente está remunerada a un tipo de interés que suele ser bajo</rdfs:comment>

</owl:Class>

<owl:Class rdf:ID="Department">

<rdfs:subClassOf rdf:resource="#User"/>

<rdfs:comment xml:lang="es">Departamento. Area interna del Banco que tiene una misión dentro de él</rdfs:comment>

<rdfs:comment xml:lang="en">Internal area of the bank that performs a specific function</rdfs:comment>

</owl:Class>

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

<rdfs:comment xml:lang="es">Cualquier producto bancario que requiere la firma de un contrato (ejemplo: una cuenta corriente o un crédito). </rdfs:comment>

<rdfs:comment xml:lang="en">Bank product that requires the signature of a contract between the customer and the bank</rdfs:comment>

</owl:Class>

<owl:Class rdf:ID="Service">

<rdfs:comment xml:lang="es">Service es el tipo de cosas que se pueden hacer pero que no requieren contrato (ejemplo : una orden de transferencia). Service tambien es cualquier producto no financiero que distribuya un banco.</rdfs:comment>

<rdfs:comment xml:lang="en">Financial products offered by a bank or services that do not require a contract, like a bank transfer order</rdfs:comment>

</owl:Class>

<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="password">
  <rdfs:domain rdf:resource="#User"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="cancelationCommission">
  <rdfs:range rdf:resource="#Quota"/>
  <rdfs:comment xml:lang="es">Comisión de cancelación</rdfs:comment>
  <rdfs:domain rdf:resource="#CurrentMortgageLoan"/>
  <rdf:type
rdf:resource="http://www.w3.org/2002/07/owl#InverseFunctionalProperty"/>
  <rdfs:comment xml:lang="en">Commission to be paid when a mortgage is
cancelled</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="service">
  <rdfs:domain rdf:resource="#ServiceContractedByCustomerInChannel"/>
  <rdfs:range rdf:resource="#Service"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="channel">
  <rdfs:range rdf:resource="#Channel"/>
  <rdfs:domain rdf:resource="#ServiceContractedByCustomerInChannel"/>
</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="subrogationCommission">
  <rdfs:comment xml:lang="en">Commission to be paid when a mortgage is
subrogated</rdfs:comment>

```

```

<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Comisión de subrogación.</rdfs:comment>
<rdfs:domain rdf:resource="#FutureMortgageLoan"/>
<rdfs:range rdf:resource="#Quota"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="payments">
  <rdfs:domain rdf:resource="#SavingAccount"/>
  <rdfs:comment xml:lang="en">Payments due in a saving account</rdfs:comment>
  <rdfs:range rdf:resource="#Payment"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="customer">
  <rdfs:range rdf:resource="#Customer"/>
  <rdfs:domain rdf:resource="#ServiceContractedByCustomerInChannel"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="interestRateType">
  <rdfs:range rdf:resource="#ProductRateApplication"/>
  <rdfs:comment xml:lang="en">Type of interest rate of a bank
product</rdfs:comment>
  <rdfs:domain rdf:resource="#Product"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="CIF">
  <rdfs:comment xml:lang="es">Código de Identificación Fiscal</rdfs:comment>
  <rdfs:domain rdf:resource="#Company"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="currencyProduct">
  <rdfs:domain rdf:resource="#Product"/>
  <rdfs:range rdf:resource="#Currency"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="rateVariable">
  <rdfs:range rdf:resource="#ProductRateApplicationVariable"/>
  <rdfs:domain rdf:resource="#ProductRateApplicationMixed"/>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="interesDelay">

```

```
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
<rdfs:domain rdf:resource="#FutureMortgageLoan"/>
<rdfs:comment>Interes de demora. No es necesario para simulación</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="signalDateContract">
  <rdfs:domain rdf:resource="#Product"/>
  <rdfs:comment>Fecha que se firma el contrato del producto financiero.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="endingDate">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
  <rdfs:domain rdf:resource="#Quota"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="name">
  <rdfs:comment>Nombre del producto financiero.</rdfs:comment>
  <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:DatatypeProperty rdf:ID="typeReferenceRate">
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
        <rdf:first>Euribor</rdf:first>
        <rdf:rest rdf:parseType="Resource">
          <rdf:rest rdf:parseType="Resource">
            <rdf:first>IRPH-cajas</rdf:first>
```

```

    <rdf:rest rdf:parseType="Resource">
      <rdf:first>IRPH-ent</rdf:first>
      <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:rest>
  </rdf:rest>
  <rdf:first>CECA</rdf:first>
</rdf:rest>
</owl:oneOf>
</owl:DataRange>
</rdfs:range>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="saleCostProperty">
  <rdfs:domain rdf:resource="#CurrentMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="buyCostProperty">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment xml:lang="es">Valor de la propiedad asociada a la hipoteca</rdfs:comment>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:comment xml:lang="en">Value of the land or property associated to a mortgage</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="expirationDate">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
  <rdfs:comment>Fecha en la que expira el producto financiero. p.e. Plazo fijo.</rdfs:comment>
  <rdfs:domain rdf:resource="#Product"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="term">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:comment>Plazo de amortización de la hipoteca.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="interestRateValue">

```

---

```
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
<rdfs:comment>Valor numerico del tipo de interes</rdfs:comment>
<rdfs:domain>
  <owl:Class>
    <owl:unionOf rdf:parseType="Collection">
      <owl:Class rdf:about="#Product"/>
      <owl:Class rdf:about="#ProductRateApplication"/>
    </owl:unionOf>
  </owl:Class>
</rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="lifeInsurance">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdfs:comment>Indica si los suscriptores de la hipoteca tienen un seguro de vida cuyo beneficiario es la hipoteca.</rdfs:comment>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="initialPeriod">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
  <rdfs:comment>Periodo de tiempo en hipotecas de interes variable en el que se paga tipo de interes fijo?</rdfs:comment>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="startingDate">
  <rdfs:domain rdf:resource="#Quota"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="interestNextRevision">
  <rdfs:domain rdf:resource="#CurrentMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="typeOfRate">
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
```

---

```

<rdf:rest 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>variable</rdf:first>
  </rdf:rest>
  <rdf:first>mixed</rdf:first>
</rdf:rest>
<rdf:first>fixed</rdf:first>
</owl:oneOf>
</owl:DataRange>
</rdfs:range>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="initalQuota">
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Cuota inicial a pagar.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="revisionTerm">
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
  <rdfs:comment>Periodo de revisión. Tiempo en el que se revisará el tipo de
  interes</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="periodicityCuota">
  <rdfs:comment>Periodos en los que se paga la cuota cada tres meses, 12 cuotas al
  año etc.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="delayInterestRate">
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:comment>Tipo de interes si se demoran pagos. No es necesario para la
  simulación.</rdfs:comment>

```

```

</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="homeInsurance">
  <rdfs:comment>Indica si el inmueble tiene un seguro.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="revisionTermNext">
  <rdfs:domain rdf:resource="#MortgageLoan"/>
  <rdfs:comment>Plazo de tiempo que transcurre hasta la proxima revision del tipo de
  interes en hipotecas de interes variable</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="mortgageTaxation">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Impuestos de la hipoteca.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="login">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#User"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="capital">
  <rdfs:comment xml:lang="es">Importe de la hipoteca, capital
  prestado</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
  <rdfs:domain rdf:resource="#MortgageLoan"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="APR">
  <rdfs:comment>Tasa anual efectiva. Poner formula matemática</rdfs:comment>
  <rdfs:comment xml:lang="es">Tasa Anual Efectiva (TAE)</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:comment xml:lang="en">Annual Percentage Rate</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#Product"/>

```

```
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="quotaAfterRevision">
  <rdfs:comment xml:lang="es">Cuota estimada tras la próxima revisión del tipo de
interés</rdfs:comment>
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="handlingCapital">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:domain rdf:resource="#CurrentMortgageLoan"/>
</owl:DatatypeProperty>
<owl:FunctionalProperty rdf:ID="openingCommission">
  <rdfs:domain rdf:resource="#FutureMortgageLoan"/>
  <rdfs:comment>Comisión de apertura.</rdfs:comment>
  <rdfs:range rdf:resource="#Quota"/>
  <rdfs:comment xml:lang="en">Commission to be paid when a mortgage is
opened</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="termRateFixed">
  <rdfs:domain rdf:resource="#ProductRateApplicationMixed"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#duration"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="value">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
</rdf:RDF>
```