An Interoperability Approach for Enabling Access to e-Justice Systems across Europe

Enrico Francesconi

ITTIG-CNR - via de' Barucci 20, Florence, Italy

Abstract. The creation of a pan-European area of Justice is one of the leading policies of the EU: to this aim the development of e-Justice services across Europe has been promoted within the e-CODEX project. In this paper an overview of the e-Justice platform architecture developed by e-CODEX, as well as the semantic solution conceived to transmit business documents in the domain of Justice within a scenario characterized by different languages and different legal systems, are described.

Keywords: e-Justice, Semantic interoperability, Knowledge representation, e-Delivery, Domain Modeling, Document Modeling.

1 Introduction

Over the last few years the European Union has encouraged policies towards the creation of a pan European judicial area as a main pillar for the creation of a new concept of European citizenship based on the certainty of the law and the effectiveness of rights. In this respect the European e-Justice Strategy [1] and Action Plan [2] promoted the development of the European e-Justice Portal, as well as projects able to create direct services for the citizens able to facilitate access to the information in the field of justice, dematerialization of proceedings, as well as communication between judicial authorities. The e-Justice Portal is now a reality[1], targeted to represent a front end for citizens and companies, for instance to file a claim within the domain of civil law. The aim is to reduce operating costs and procedural deadlines in the administration of Justice, to facilitate the access to cross-border judicial procedures for citizens and, in the end, to create a system of e-Justice in the European multi-language framework.

In this context the e-CODEX[2] project is a Large Scale Pilot in the domain of e-Justice, aiming to implement building blocks for a system supporting cross borders judicial procedures between European Member States and to provide citizens, enterprises and legal professionals with an easier access to transnational justice. In this respect it is not intended to replace national solutions but to provide standards and tools for information exchange and interoperability in

[1] `http://e-justice.europa.eu` (Retrieved on 31/03/2014).

[2] e-Justice Communication via Online Data EXchange (`http://www.e-codex.eu`) (Retrieved on 31/03/2014).

A. Kő and E. Francesconi (Eds.): EGOVIS 2014, LNCS 8650, pp. 26–40, 2014.

the software tools, respecting the existing diversity. Transport of data and documents is a key target of the e-CODEX platform. In a transnational settings it means transport of information from one country to another, also including communication between the e-Justice Portal and national systems.

In this paper the main features of the e-CODEX system, based on semantic technologies and Web services, will be summed up. In particular the relation with other similar pilots (Section 2) and the architecture of the e-Delivery platform (Section 3) will be presented. Moreover the approach, based on document standards and semantic models, able to provide a semantic interoperability layer for message exchange will be described (Sections 4, 5, 6). In particular (Section 7) such knowledge modeling approach deployed on a specific example is presented. Finally some conclusions and future developments are discussed (Section 8).

2 Related Projects

The e-Justice pilot represented by e-CODEX is not intended to operate in isolation but is able to benefit strongly from the experiences and results of the other Large Scale Pilots (LSPs) and also other pan-European e-Government projects. Especially with regard to the other LSPs, the e-Justice pilot aims to build on existing products and standards already created in the other projects, in particular PEPPOL, STORK and SPOCS.

PEPPOL[3] aims at enabling seamless cross-border e-Procurement, connecting communities through standard-based solutions. To this aim it enables access to the Business Document Exchange Network (BUSDOX), its standards-based IT infrastructure for metadata transport service based on OASIS BDX. It provides services for e-Procurement with standardised electronic document formats, with the aim to facilitate the pre-award and post-award procurement process.

STORK[4] and SPOCS[5] are meant to allow citizens to establish new e-relations across borders. STORK, in particular, is targeted to establish a European eID Interoperability Platform; SPOCS, on the other hand, aims to support small and medium enterprises delivering services in all Member States through the provision of seamless electronic procedures by building cross-border solutions based on each country's existing systems. Both projects use the same e-Delivery solution exploiting the standardization work in the area of Registered E-Mail (REM) using ETSI specifications (ETSI-REM) but also the generalized implementation of transportation standards based on the Web Services Stack and SOAP (OASIS ebMS).

The solutions provided by such LSPs represent the infrastructure which the e-CODEX platform is based on; in this respect, and for explicit mandate of the

[3] Pan-European Public Procurement Online (`http://www.peppol.eu`) (Retrieved on 31/03/2014).

[4] Secure idenTity acrOss boRders linKed (`https://www.eid-stork.eu`) (Retrieved on 31/03/2014).

[5] Simple Procedures Online for Cross-border Services (`http://www.eu-spocs.eu`) (Retrieved on 31/03/2014).

EU Commission, the e-CODEX platform is going to represent the convergence solution for the other LSPs.

3 The Architecture of the e-CODEX e-Delivery Solution

The e-CODEX platform for e-Delivery solution will provide facilities for cross border communication via gateways, behind which national domains should stay unchanged. It aims to implement functionalities of reliable messaging delivery between national gateways, including persistence, timestamps to track the chain between sender and receiver, evidences of delivery and acceptance, large message handling, security and encryption of messages.

To guarantee such a reliable messaging between the actual endpoints located within the national domains a so-called "circle of trust", based on legal agreements, is established. Moreover, to provide reliability and non-repudiation between endpoints, the e-Delivery convergence scenario also foresees standardized evidences based on ETSI REM specifications [3]. Gateways will be endowed with routing capabilities able to resolve gataway physical addresses and national competent courts from a central/decentral DB including national filing system IDs for integration into existing national infrastructure.

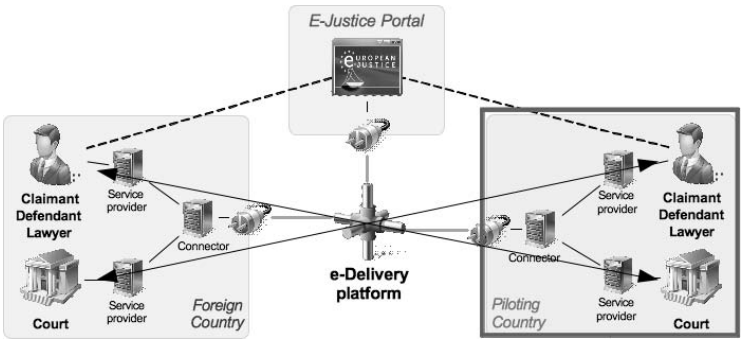


Fig. 1. High level architecture

The high level architecture, based on PEPPOL, is sketched in Fig. 1: it shows a basic architecture of the e-Delivery solution, set up by national gateways which are bilaterally connected to each other, consequently there is no central hub in the middle. National gateways interconnect to the national systems respective applications by adapters (here called 'connectors') which handle the format used by e-CODEX with respect to national oriented communication and formats. The interoperability framework is, on the other hand, represented by an interoperability layer including profiles of secure and reliable transport standards, as OASIS ebMS 3.0 format for message exchange, ETSI-REM evidence format, Web services engines based on Apache Axis2[6] architecture, as well as a semantic layer

[6] `http://axis.apache.org` (Retrieved on 31/03/2014).

necessary for negotiating concepts between different Member States and legal systems (see Section 4).

The open source product Holodeck[7] is used as basic infrastructure to implement business documents exchange using ebMS 3.0 standard. This will serve as the basis for the e-CODEX gateway. The reason for choosing this product is that it is freely useable (open source), easily extensible and natively implements an ebMS 3.0 stack.

The development of 'connectors' between national gateways and national information systems is up to each Member State. Connectors act as an interface between national and European e-Delivery systems, keeping national systems unchanged, nevertheless facilitating message routing according to the schema reported in Fig. 2. In this picture the connector functions, concerning the trust and evidence components as well as metadata and address lookup for forwarding messages to the target gateways, are highlighted. Similarly, the transformation of messages to/from EU format and semantic intermediary functions of the interoperability layer are sketched. The way such semantic intermediary functions are implemented in the project are discussed in the next sections with respect to the foreseen use cases.

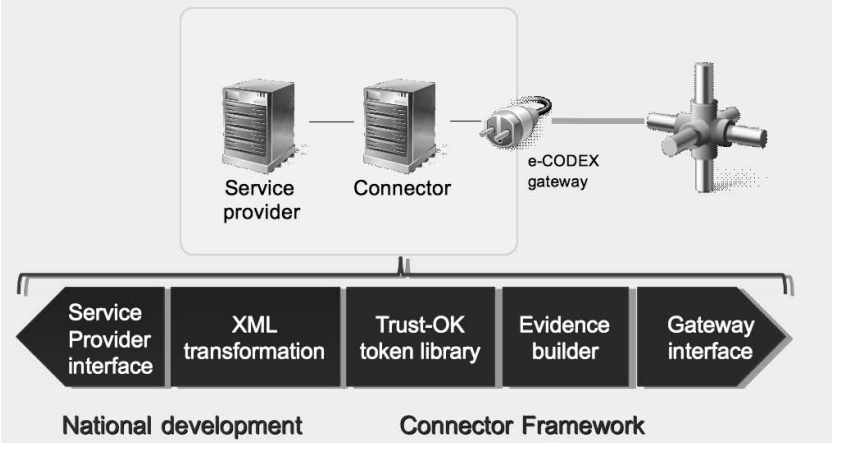


Fig. 2. e-CODEX message routing

4 Semantic Interoperability

For the purposes of e-CODEX message exchange between Member States, having different legal systems and traditions, it is essential to provide a semantic interoperability layer for sharing and harmonizing the meaning of national jurisdiction-dependent concepts. For the piloting phase of the project two use cases have been foreseen: they are related to the exchange of application forms

[7] `http://holodeck-b2b.sourceforge.net` (Retrieved on 31/03/2014).

within the EU Small Claims and European Payment Order procedures, as ruled by the corresponding EU regulations ([4] [5] [6]). Country-dependent legal systems, as well as the diversity of languages, make the exchange of legal information between Member States a challenging task. For this purpose a conceptual model, formalized in an ontology, is necessary for negotiating concepts between different legal systems.

To approach the complexity of the EU multilingual legal scenario, as well as to align concepts of the EU legal domain, one cannot just transfer the conceptual structure of a legal system to another, because of different national legal contexts and legislative cultures within EU Member States [7] [8]. A similar problem arises even with regards to the obligation of EU Member States to implement European Directives into national laws. Far from being a straight transposition, this process usually includes a further step in which European Directives are subject to interpretation which can lead to diverging legislation within the Member States (see [7] for interesting examples). With respect to other domains where conceptual negotiations mainly pertain to linguistic aspects (as for example the e-Health domain), in the e-Justice one, meanings negotiation addresses legal concept nuances in different legal systems and traditions. On the other hand shared interpretation of legal concepts is a pre-condition of EU regulations, which directly apply at national levels.

The literature offers different methods to approach the multilingual complexity of the European law, for example controlled vocabularies implemented in a terminology database (such as IATE, used by all the main EU Institutions), thesauri (as EUROVOC), semantic lexicons or lightweight ontologies as WordNet ([9], [10], [11]). The alignment of multilingual terminologies can be effectively obtained by using a pivot language. More expressive descriptions of concepts associated with lexical units can be represented in domain ontologies (or statute specific ontologies), representing concepts used in a specific statute (as IPROnto [12]). More general organizations of domain concepts are addressed in literature as core ontologies (as LRI-Core [13], LKIF [14] and CLO [15] for the legal domain), while foundational concepts categories, applicable to all domains, are usually addressed in top or foundational ontologies (as SUMO [16] and DOLCE [17]). Such ontologies represent conceptual systems aimed at base-concepts sharing and promoting consensus in building more specific ontologies for specific domains or activities. The integration of different lexical resources (heterogeneous because of belonging to different law systems, or expressed in different languages, or pertaining to different domains) can be carried out in different fashions: 1) generate single resources (merging); 2) compare and define correspondences and differences (mapping); 3) combine different levels of knowledge, basically interfacing lexical resources and ontologies.

The use of a pivot conceptual structure is generally recommended in order to provide a reference for negotiating concepts meaning between Member States, thus providing a layer of legal concepts harmonization in view of the creation of a pan-European judicial area. In this respect the methodological approach

chosen in the e-CODEX project is to combine different levels of knowledge, where national legal concepts are reconciled or mapped towards a more general conceptual model.

5 Modeling Semantic Interoperability

e-CODEX uses a 3-levels model towards semantic interoperability: conceptual, logical and physical. The *Conceptual model* is the model for communication and harmonization. It guides and supports business and IT to create the foundation for information exchange, through reuse of experience and application of already known and used concepts. The *Logical model* is the set of data types and code lists ensuring that data definitions are derived methodologically to enhance reusability at the physical level (for e-CODEX the CCTS[8] standards are used). The *Physical model* is the syntax and data formats ensuring mutual understanding between systems of information exchanging partners (XML/XSD and PDF are example of syntax and data formats at physical layer).

5.1 Domain and Document Modeling

The three layers of abstraction introduced so far (conceptual, logical and physical) allow us to identify both the conceptual and technical (data types and syntax) building blocks for describing document types and domain concepts to be exchanged: they represent a methodological framework which is followed by e-CODEX. The main requirement of the project is that, while legal concepts at EU level have different nuances in different legal systems and traditions, e-CODEX documents, pertaining to specific legal procedures, have a structure regulated by the related directives, valid for all the Member States jurisdictions.

Within such framework, proper domain and document modelling have been conceived to address the e-Justice cross-border data/documents exchange as exemplified by the foreseen use cases.

The analysis of the e-CODEX use cases regulations, referred in Section 4, and of the related application forms, identified the following steps and formats for business document exchange, as implemented through the EU e-Justice portal:

- To generate and sign a PDF version of a Web filled form;
- To generate a machine readable version (typically in XML) from the same Web filled form;
- To deliver both signed PDF and XML versions of the form.

In this scenario the descriptions of both domain concepts, addressed in the use cases forms, and form instances are essential requirements for modeling the e-CODEX form generation and delivery. In particular we can distinguish between *Domain Model*, as the model of the scenario to be addressed, and *Document*

[8] UN/CEFACT Core Components Technical Specification. Version 3.0. Second Public Review. 16-April-2007.

Model, as the model of a document instance (in our case a form) pertaining to that scenario. Each of them can be furtherly distinguished as follows.

In a bottom-up modeling approach, the Document Model can be viewed according to two layers of abstraction, whose definitions follow those firstly given in literature in the early nineties in [18–20]. The two layers, in fact, are defined as follows:

- The *Document Physical Model* is the collection of the document objects viewed on the basis of their physical, domain independent, function. In e-CODEX it represents the view of a document form in terms of physical components (ex: input fields, check boxes, radio buttons, labels, text boxes, etc.). A specific PDF form or an HTML form are instances of the Document Physical Model.
- The *Document Logical Model* is the collection of the document objects, viewed on the basis of the human-perceptible meaning of their content. In e-CODEX it represents the view of a document form in terms of logical components: ex. Claimant, Claimant name, Claimant address, Court name, etc, as well as their values and relations. A specific XML or an RDF set of triples are instances of the Document Logical Model.

According to the same bottom-up modeling approach, the Domain Model can be viewed according to two layers of abstraction:

- The *Domain Logical Model* is the set of building blocks (data types, code lists, etc.) to describe the documents of a particular domain of interest.
- The *Domain Conceptual Model* is a semantic description of the scenario (entities and relations) of a specific domain. In e-CODEX it allows us to provide meaning to the document physical objects: it gives semantic interpretation to the document elements (physical objects) in terms of logical objects, and it can be represented by element hierarchies (XMLSchema) or ontologies (RDFS/OWL).

Summing up this modeling approach, we can distinguish the following modeling layers and hierarchies:

1. Domain Model
   1.a) Domain Conceptual Model;
   1.b) Domain Logical Model;
2. Document Model
   2.a) Document Logical Model;
   2.b) Document Physical Model.

See also Fig. 3 showing the relationships between Domain and Document Models.

In this view, the two sub-layers of the Document Model are different levels of abstraction (physical and logical) for modeling a document instance. On the other hand, the two sub-layers of the Domain Model are the description of the scenario in terms of concepts and relations between them (Domain Conceptual

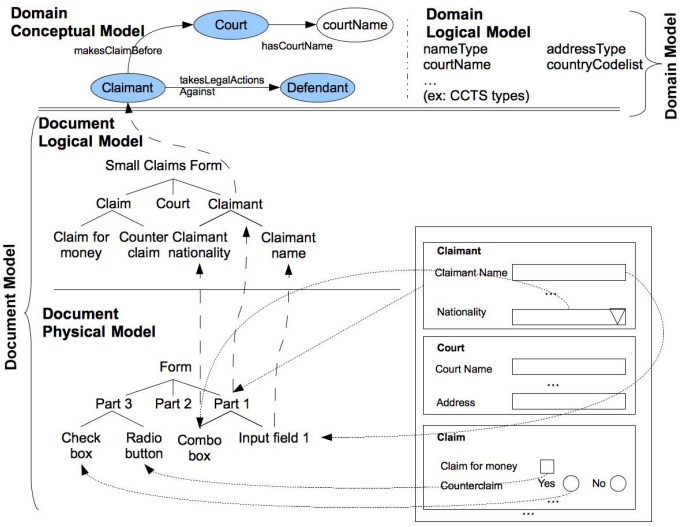


Fig. 3. Relations between Domain and Document Models

Model) as well as data types (Domain Logical Model) according to which you give logical meaning to the document physical components. In other words, they are the semantic instruments to view document physical objects in terms of document logical objects.

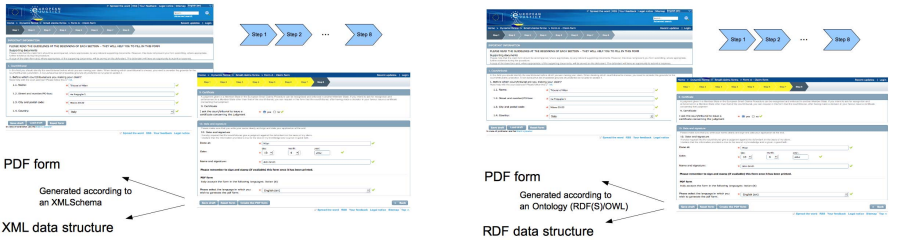
6 Technical Implementation of the Modeling Layers

From a technical point of view two strategies for implementing the knowledge modeling proposed in Fig. 3 are being carried out, according to different degrees of complexity, so that they can be viewed in a short or long term.

6.1 Short Term Strategy

In a short term strategy, needed for the e-CODEX piloting phase, the modeling layers are implemented using semantic tools with a limited degree of expressivity. According to this strategy, while the Document Physical Model is the view of an HTML or PDF form in terms of physical objects, the Document Logical Model is the view of such objects as logical components, described by an XML file, compliant to an XMLSchema representing the Domain Model including elements and relations (Domain Conceptual Model), as well as datatype (Domain Logical Model) (Fig. 4a). In Tab. 1 such knowledge modelling and its technical implementation for the e-CODEX short term strategy are reported.

For implementing such modeling strategy, a 'core-team' of data modelers has been established: it is responsible for creating, editing and extending the concept of a shared semantic library. This limited amount of staff members creates the



(a) Short term strategy (b) Long term strategy

Fig. 4. Short and long term strategy form generation

concepts based on the articulated information requirements from the use cases. A created concept is presented to a 'user council' in order to approve a concept for use. The 'user council' is formed by all stakeholders of the semantic library. Finally a 'schema creation group' has been formed, responsible to create and maintain an XML Schema based on the available semantic library.

Table 1. e-CODEX "short term strategy"

Knowledge Modeling	**Technical Implementation**
Domain Model	
a) Domain Conceptual Model	XMLSchema
b) Domain Logical Model	Data types, code lists (ex. CCTS or specific e-CODEX proprietary datatypes)
Document Model	
a) Document Logical Model	XML file
b) Document Physical Model	HTML or PDF forms

6.2 Long Term Strategy

In a long term, e-CODEX knowledge modeling is supposed to develop a solution with a high degree of expressivity in order to describe the complexity of the scenario to be addressed and to cope with sustainability requirements. For these reasons a more complex knowledge modeling solution can be foreseen.

Table 2. e-CODEX "long term strategy"

Knowledge Modeling	**Technical Implementation**
Domain Model	
a) Domain Conceptual Model	RDFS/OWL model (ontology)
b) Domain Logical Model	Data types, code lists (ex. CCTS or specific e-CODEX property datatypes)
Document Model	
a) Document Logical Model	RDF file
b) Document Physical Model	HTML or PDF forms

According to this long term solution, the Document Physical Model is the view of an HTML or PDF form in terms of physical objects, the Document Logical Model is the logical view of such objects that can be described by an RDF file able to represent statements over entities, including qualified relations (Fig. 4b). The meaning of such entities and relations can be given by an ontology (Domain Model) of classes and relations (Domain Conceptual Model) as well as datatype and codelists (Domain Logical Model). In Tab. 2 such knowledge modeling and its technical implementation for the e-CODEX long term strategy are reported.

Differently from the short term strategy (Domain Model expressed by an XMLSchema), in a long term strategy the Domain Model is expressed using RDFS/OWL technologies, so to provide a more detailed representation of the meaning of the concepts involved and a more expressive description of the relations between them. An excerpt of concepts and qualified relations between the actors involved in the e-CODEX domain is reported in Fig. 5. It represents an excerpt of the general scenario of a claim including its basic players: Claimant, Defendant and Court, as well as their mutual relationships. In the e-CODEX knowledge modeling language, it represents an excerpt of an e-CODEX Domain Model: it is composed by the Domain Conceptual Model (concepts and relationships) and the Domain Logical Model (data types, code lists, etc. associated to concepts and relationships).

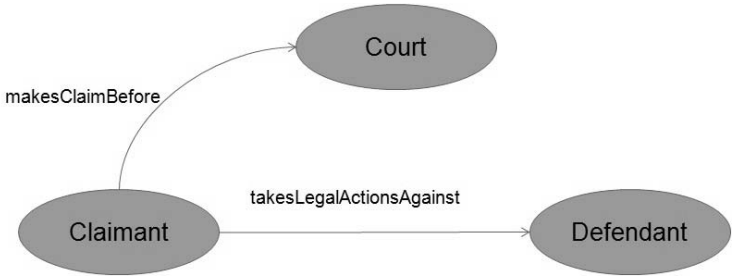


Fig. 5. e-CODEX Domain Model excerpt

An important goal of the Domain Model is to overcome the project finding that "all legislation seems to define its own semantics". e-CODEX noticed that currently each time a legal procedure is taken up for electronic proceeding basic legal concepts have to be analyzed and modeled to match exactly the definition in the legislation at hand. Notwithstanding the necessity for nuances in legal matters, the aforementioned legal concepts are of such generic nature that harmonization seems possible and desirable. Therefore the e-CODEX working group on semantics proposes to develop Core Legal Concepts, as a ground to develop a Domain Model, following the methodology used by the European Commission

DIGIT's ISA Program[9]. The idea is to harmonize data definitions to the benefit of electronic proceedings through the introduction of Core Legal Concepts. Also, such Core Legal Concepts would enable faster electronic deployment of cross border legal procedures.

ISA has in particular provided specific recommendations for concepts identification, both in terms of format and of design rules and management, in order to guarantee persistence and long term maintenance. As recommended by the ISA initiative[10], Core Vocabularies are to be published in multiple formats, including RDF to be useful for linked data applications. This entails that vocabulary terms have to be identified by dereferentiable http URIs.

Following such URIs pattern suggestions for vocabularies, the terms of a Core Legal Concepts vocabulary can be identified by the following hash URI namespace: `http://[URIroot]/def/CoreLegalConcepts#`, where `[URIroot]` is the domain name of the provider. For example the URI for the concept Claim, represented in the Core Legal Concept vocabulary, will be: `http://[URIroot]/def/CoreLegalConcepts#Claim` ; such URI will point to the latest version of related vocabulary. In order to distinguish between different versions of the same vocabulary, as well as different meaning of the same terms in different vocabulary versions, it is recommended that the version date of the vocabulary is added to the vocabulary namespace, according to the following pattern `http://[URIroot]/def/{year}/{month}/{day}/CoreLegalConcepts#`

7 e-CODEX Knowledge Modeling Deployed on Example

In this section a deployment of the e-CODEX knowledge modeling architecture, based on semantic technologies, in particular on RDF(S)/OWL, is shown. A narrative example, here below, concerning a scenario about a dispute leading litigants to start a European small claim procedure, is used as example:

> *Franz von Liebensfels from Klagenfurt rented an Opel Astra on the Internet for use in Portugal. He collected the car from Rental Car company's office in a street in the centre of Lisbon. Due to the existence of damage to the vehicle he decided to go to the company's office at the airport and the employee agreed to the change. The employee inspected the Opel Astra and discovered damage to the windscreen. Mr. Liebenfels assured him that this was already there when he had collected the vehicle. The consumer subsequently saw that his credit card had been charged with the sum of 400 Euro. He decides to file a claim against Rental Car at the court of Lisbon using the European Small Claim Procedure.*

The narrative of Franz von Liebensfels and his car rental, can be generalized and summarized into a more abstract narrative as follows:

[9] DIGIT: Directorate-General for Informatics; ISA: Interoperability Solutions for European Public Administration.

[10] PwC EU Services EESV, "D3.1 – Process and Methodology for Core Vocabularies", ISA – Interoperability Solutions for European Public Administrations.

A claimant from a Member State files a claim against a defendant in another Member State. The claimant filed the claim at a court in the other Member State demanding reimbursement of the money taking form his credit card by the defendant.

The two narratives at different levels of abstraction are the extensional (real case) description and intentional (generalization) model, respectively, of a small claim procedure. In the language of the e-CODEX knowledge modeling they can be, respectively, represented in terms of:

- Document Model, namely the document description of the specific case including real players and their relations, as well as the document physical template that generates the logical description of the real case;
- Domain Model, namely the description of the general scenario of a small claim procedure, including actor categories and relations.

In the e-CODEX knowledge modeling approach, the extensional description of the real case is represented by an e-CODEX Document Logical Model generated by a document template (Document Physical Model) which, in our narrative case, is a form pertaining to the Small Claim procedure, properly filled in by the claimant. The connection between the extensional and intensional representations of a small claim scenario stemming from our example is shown in Fig. 6, where individuals and related concepts are represented at different levels of abstraction.

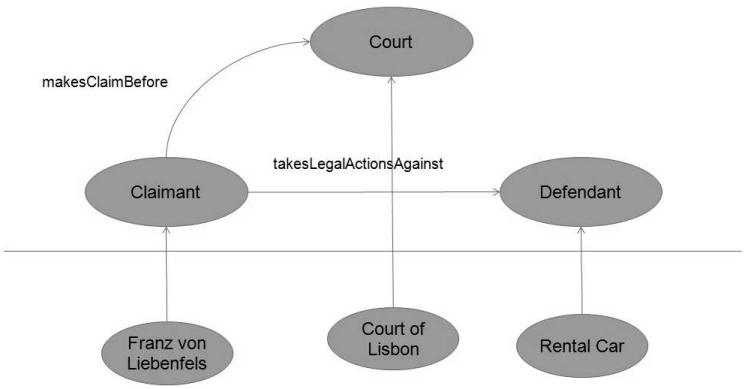


Fig. 6. Relation between extensional (Document Logical Model) and intensional (Domain Model) representations (lower and upper part, respectively) of a small claim scenario

Here below an RDFS/OWL the Court-Claimant-Defendant scenario and the RDF/XML serialization of the narrative instance of it, addressed in this paper where pre-defined URI naming conventions for concepts and documents are used, are here below respectively reported.

Small Claims Domain Model Excerpt in RDF(S)-OWL/XML

```
<?xml version="1.0"?>
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:ESC="http://[URI root]/def/EuropeanSmallClaims#">

     <owl:Class rdf:ID="ESC:Court"/>

     <owl:Class rdf:ID="ESC:Claimant">
         <rdfs:subClassOf rdf:resource="ESC:Person"/>
     </owl:Class>
     <owl:Class rdf:ID="ESC:Defendant">
         <rdfs:subClassOf rdf:resource="ESC:Person"/>
     </owl:Class>
      ...
     <owl:ObjectProperty rdf:ID="makesClaimBefore">
         <rdfs:comment>   Definition of makesClaimBefore property  </rdfs:comment>
         <rdfs:domain rdf:resource="#Claimant"/>
         <rdfs:range  rdf:resource="#Court"/>
     </owl:ObjectProperty>
     <owl:ObjectProperty rdf:ID="takesLegalActionAgainst">
         <rdfs:comment>   Definition of takesLegalActionAgainst property   </rdfs:comment>
         <rdfs:domain rdf:resource="#Claimant"/>
         <rdfs:range  rdf:resource="#Defendant"/>
     </owl:ObjectProperty>
      ...
</rdf:RDF>
```

Small Claims Document Logical Model Excerpt in RDF/XML

```
<?xml version="1.0"?>
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:ESC="http://[URI root]/def/EuropeanSmallClaims#">
     <rdf:Description rdf:about="[FormInstanceURI]#id1">
         <rdf:type rdf:resource="ESC#Court"/>
         <ESC:hasCourtName>Court of Lisbon</ESC:hasCourtName>
         <ESC:hasCourtAddress>Rua Polo Sul 43, Lisboa</ESC:hasCourtAddress>
         <ESC:hasCourtCountry>Portugal</ESC:hasCourtCountry>
     </rdf:Description>
     <rdf:Description rdf:about="[FormInstanceURI]#id2">
         <rdf:type rdf:resource="ESC#Claimant"/>
         <ESC:hasClaimantName>Franz von Liebenfels</ESC:hasClaimantName>
         <ESC:hasClaimantAddress>Museumstrasse 12,Klagenfurt</ESC:hasClaimantAddress>
         <ESC:hasClaimantCountry>Osterreich</ESC:hasClaimantCountry>
     <rdf:Description rdf:about="[FormInstanceURI]#id3">
         <rdf:type rdf:resource="ESC#Defendant"/>
         <ESC:hasDefendantName>Rental Car</ESC:hasDefendantName>
         <ESC:hasDefendantAddress>Avenida Sol 1345,Lisboa</ESC:hasDefendantAddress>
         <ESC:hasDefendantCountry>Portugal</ESC:hasDefendantCountry>
     </rdf:Description>
    ...
  </rdf:RDF>
```

8 Conclusions

The e-CODEX project aims to represent an effective implementation of the current e-Justice policies of the European Union towards e-Justice, as well as a basic framework for other pan-European e-Government projects. Legal contents representation and content transport infrastructure are the key activities currently

under implementation in a scenario characterized by language and legal systems diversity. Both activities aim to create an interoperability framework based on standards and semantic tools to start and carry out judicial procedures on-line. In particular a legal knowledge modeling approach to promote semantic interoperability for e-Justice in the multilingual and multi-cultural complexity of the EU legal scenarios is proposed and implemented by RDF(S)/OWL technologies. In the next phases of the project particular attention will be payed to the implementation of a secure and reliable data exchanged system, based on evidences and circle of trust, as well as an e-Payment system for a complete on-line finalization of the judicial proceedings.

References

1. European Commission. Towards a European e-justice strategy (2008)
2. European Union Institutions and Bodies. Multi-annual European e-justice action plan 2009-2013 (2009)
3. ETSI. Electronic signatures and infrastructures (esi); registered electronic mail (rem); part 2: Data requirements, formats and signatures for rem. Technical Report ETSI TS 102 640-2, ETSI, v.2.1.1 (2010)
4. The European Parliament and the Council of the European Union. Regulation of the european parliament and of the council of 11 July 2007 establishing a European small claims procedure (July 2009)
5. The European Parliament and the Council of the European Union. Regulation of the European parliament and of the council of 12 December 2006 creating a European order for payment procedure (December 2006)
6. Contini, F., Lanzara, G.F. (eds.): The Circulation of Agency in E-Justice. Interoperability and Infrastructures for European Transborder Judicial Proceedings. Law, Governance and Technology Series, vol. 13. Springer (2014)
7. Ajani, G., Lesmo, L., Boella, G., Mazzei, A., Rossi, P.: Terminological and ontological analysis of European directives: multilingualism in law. In: Proceedings of International Conference on Artificial Intelligence and Law, pp. 43–48. ACM (2007)
8. Van Laer, C.J.P.: The applicability of comparative concepts. Electronic Journal of Comparative Law 2(2) (1998)
9. Fellbaum, C. (ed.): WordNet: An Electronic Lexical Database. MIT Press, Cambridge (1998)
10. Vossen, P. (ed.): EuroWordNet: A Multilingual Database with Lexical Semantic Networks. Kluwer Academic Publishers, Dordrecht (1998)
11. Sagri, M.-T., Tiscornia, D.: Ontology-based models of legal knowledge. In: Wang, S., et al. (eds.) ER Workshops 2004. LNCS, vol. 3289, pp. 577–588. Springer, Heidelberg (2004)
12. Delgado, J., Gallego, I., Llorente, S., Garcia, R.: Ipronto: An ontology for digital rights management. In: Proceedings of the International Conference on Legal Knowledge and Information Systems, pp. 111–120. IOS Press (2003)
13. Breuker, J., Hoekstra, R.: Core concepts of law: taking common-sense seriously. In: Proceedings of Formal Ontologies in Information Systems (2004)
14. Hoekstra, R., Breuker, J., di Bello, M., Boer, A.: Lkif core: Principled ontology development for the legal domain. In: Breuker, J., Casanovas, P., Klein, M., Francesconi, E. (eds.) Legal Ontologies and the Semantic Web. IOS Press (2009)

15. Gangemi, A., Sagri, M.-T., Tiscornia, D.: A constructive framework for legal ontologies. In: Benjamins, V.R., Casanovas, P., Breuker, J., Gangemi, A. (eds.) Law and the Semantic Web. LNCS (LNAI), vol. 3369, pp. 97–124. Springer, Heidelberg (2005)
16. Niles, J., Pease, A.: Towards a standard upper ontology. In: Proceedings of the 2nd International Conference on Formal Ontology in Information Systems, pp. 2–9 (2001)
17. Gangemi, A., Guarino, N., Masolo, C., Oltramari, A., Schneider, L.: Sweetening ontologies with DOLCE. In: Gómez-Pérez, A., Benjamins, V.R. (eds.) EKAW 2002. LNCS (LNAI), vol. 2473, pp. 166–181. Springer, Heidelberg (2002)
18. Esposito, F., Malerba, D., Semeraro, G.: Multistrategy learning for document recognition. Applied Artificial Intelligence, an International Journal 8(1), 33–83 (1994)
19. Tsujimoto, S., Asada, H.: Major components of a complete text reading system. Proceedings of the IEEE 80, 1133–1149 (1992)
20. Tang, Y.Y., De Yan, C., Suen, C.Y.: Document processing for automatic knowledge acquisition. IEEE Transation on Knowledge and Data Engineering 6(1), 3–20 (1994)