THE IMPLEMENTATION OF COMPLIANCE: LEGAL AND ETHICAL ASPECTS INTO ICT PLATFORMS

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Abstract - One of the main challenges while we creating ICT platforms are the compliance of services with legal and ethical aspects. Based on past experiences the missing or ignoring of legal aspects raises the possibility of the failure of the platforms. The legal and ethical aspects, under name compliance, have an important role in any ICT platform because they validate the business process and usually describe what should be achieved. The challenging part here is the methodology for implementation of compliance, such as legal and ethical aspects in the ICT platforms. In this paper, we propose a methodology for implementing compliance by using the Ontological Web Language - OWL, in order to validate the business processes based on compliance rules extracted from laws and ethical aspects basic principles and mapped them into OWL(XML) files.

Keywords - Legal Ontology, Methodology,OWL, Model,Compliance,ICT platform.

I. INTRODUCTION

The composition of user requirements is not just the representation of the expectation and options for users, but these requirements must comply also with the legal framework and ethical issues.The strategy is toanalyze and specify the constraints which come from legal regulations, national/international standards and policies also the ethical principles.The compliance has an important role in any domain because they validated business processes and improve the scenarios of the services. Being in a compliance with legal and ethical issues will reduce the risk for work stoppage, penalties, or even the termination of the business. As a main challenge here is the incorporation of legal constraints to an early stage of development of service. So related to this we consider as a crucial issue, the challenge which concerns the compliance of services with legal aspects and our intention is to present methodology to implement compliance into ICT platforms.

In the context of our research case study, the regulations come from labor law, standard and policies and ethical principles, are considered as part of user requirements for service engineering and for Information Systems (IS) development. Ignoring these aspects may cause the incomplete specifications of requirements, and as it is specified at [1], the design of information system which is based on service will not meet the user expectation.

The research presented in this paper is made in contextof European project (http://sponsor-aal.eu/), in the domain of Ambient Assisted Living (AAL). The main intentionof this ICT platform isto offer facilityin posting, browsing and exchanging basic informationbetween competence-offering seniors and search-based requests.

The events in context of this ICT platform come from private of public competence-demanding organizations. The benefits of using this platform for senior persons will be the enhanced of possibility to access a wide range of occupational position in, thus supporting sense-making and the well-being of seniors in occupational environments whenever possible.

This paper is organized as follows. Section 2 describes the proposed methodology for defining and composing compliance rules from legal sources, organizational documents and ethical aspects. Section 3, describes technical components which we have used to translate the meta-model into OWL, and finally the section 4, describes an example related to the methodology of working.

II. METHODOLOGICAL APPROACH

Our methodological approach proposed in the context of an ICT platform, is composed of four main steps:

a) The analysis of Universe of Discourse;
b) Context analysis/Critical situation analysis;
c) Compliance analysis;
d) Translation of Meta-Model in terms of OWL;

Figure 1, show us the relationship of each step and describedin next points in this section.

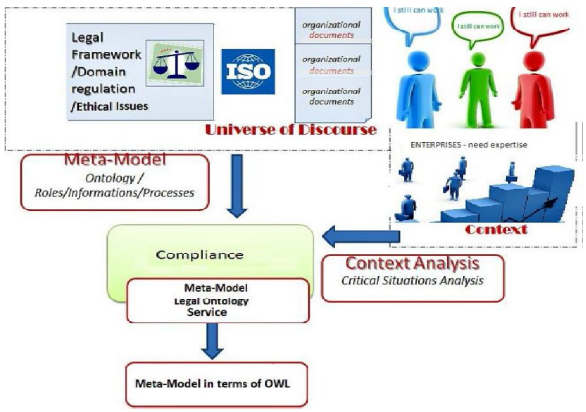

Fig.1. Methodological approach

2.1. Analysis of Universe of Discourse

In order to consider the legal framework, regulation domainand ethical issues we propose initially to identify andto analyze the set of legal sources such as laws and ethical documents, applicationsregulation, organizational documents, international organizationalstandards, to consider.By analyzing the legal framework we identify the maincharacteristic concepts of domain, the roles and the legaland ethical rules. The semantic interpretation and knowledge extractionis known to be a difficult task and it require much morethen expertise in an area of service design so sometimes thereneeded legal expertise in some situation.After analyzing the legal sources we continue to nextlevel which corresponds to formalize the knowledge extractedfrom the legal sources by using the notion of ”hyperconcept”.A ”hyperconcept” is complex concept which iscomposed from several sub concepts representing a semanticunit in the domain of analysis[2].

Related to the ICT platforms, the compliance of service scenarios with legal and ethical aspects is a crucial issue. When we composeand describe the scenarios, the legal and ethical aspects should be taken into account, otherwise it would be meaningless to formulateoptions that are contrary to the legal and ethical framework. In this context, we specify the link between service-scenarios-regulations(or rules) by modeling meta-model which is represented in section 2.3.

2.2. Context analysis/Critical situation analysis

In general there are several situationfrom the legal and ethical issues which should be considered when we consider the service scenarios.We consider a critical situation when any process is contrary tothe legal rules and ethical issues. Some cases which are as types of critical situation are presented below:

- The employee agrees with terms and condition of contract without any pressure on it;
- The employee can sign a contract only if he/she has adequate age mentioned in law;
- Termination of working contract unilateral by employee or employer;
- It is not allowed to work in urban zone with danger goods;
- There are only specified jobs which can be performed during the weekend;
- It is not allowed to push the worker to work more than what is specified in employee contract without his or her agreement;
- The harassment in workplace is considered illegal if any of these issues occurs against any of employees: national origin, person’s race, creed, color, age, ancestry,disability, sex, arrest or conviction record, marital status, sexual orientation or military services.

The cases above and many other which we could face in our daily life are very sensitive part which should be taken in account in any situation. The consideration of solving these issues is by relying on the law and ethical principles and as we have noticeably on the item above, there are cases which need to be considered additional rules in order to complete the scenarios.

The challenge is to avoid any scenario which is not in compliance with the law and ethical issues,recommended in any domain. Reasonably, this is why we use this general approach, to make the implementation for our case of the ICT platform, but this approach could be used also as a general guide for other projects. We try to avoid any scenario which is against the law and ethical issues of integration the law modules under name compliance.

2.3. Compliance analysis

In aspects of business process management, thecompliance to legal regulation, internal rules and regulationor international standards is become one of the most importantcondition to be considered.The compliance representthe set of formulated rules that could be checked duringor after execution the business process. In other words,compliance means to validate business processes [3].If any business process is detected as non-compliant then it should be redesigned, as it described in [3]. Also, as it is specified in [3] for any business process, we say that it is compliant by design if while modeling there are taken in account rules, and the advantages here are that subsequent validation is not required[3].

Compliance are usually defined withouta concert business model in mind, example in our case we initially analyze the legal text before even defining a single business rule. This is allowed to be done in advance and itdoes not face any contradiction because compliance rules are often declarative and describe what should be achieved rather than how to achieve it [3]. Regarding our work withcompliance for our case of the ICT platform, we use compliance to validate business processes and in case if any, business process is not compliant with rules defined in advance, then the service will throw a message to notify the user that theprocess in not complying with any rule or regulation defined before. In this case we use compliance by detection and more details about this are represented in Section 4.According to [4] the laws describes in precise way concepts, rules and constraints governing the institutional activities.

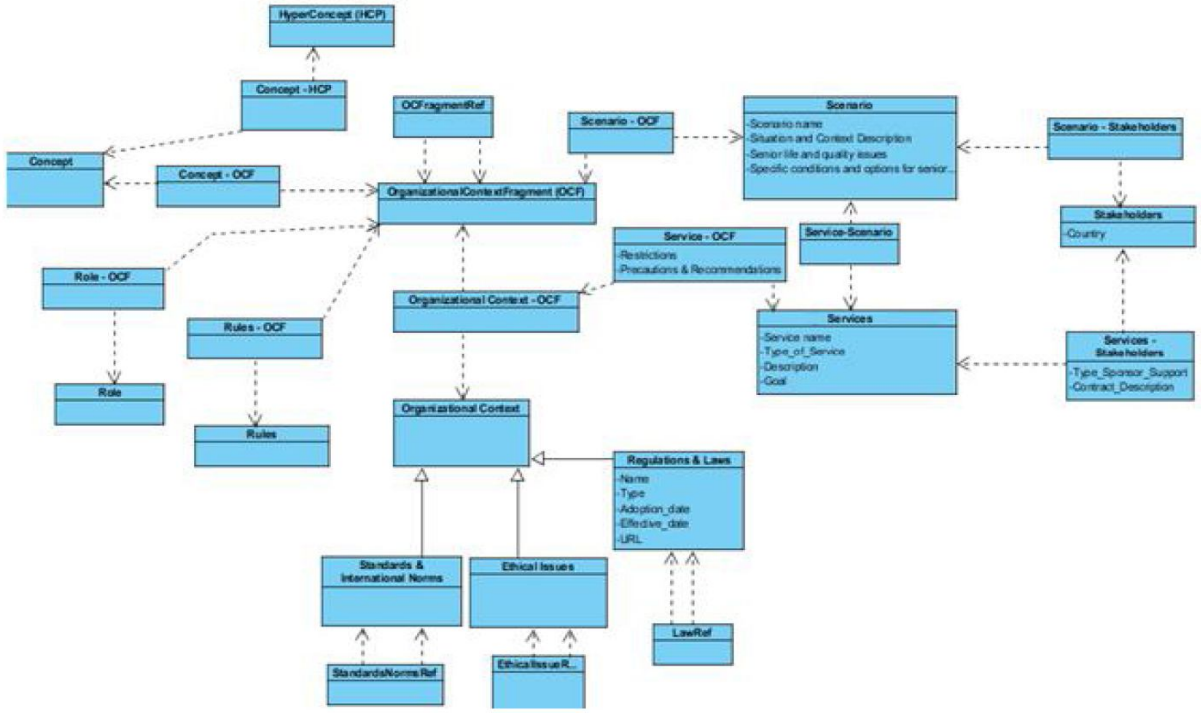

Fig.2. Meta-Model for legal framework [9]

As we have discussed in previous section (section 2.1 Analysis of Universe of Discourse) we have proposedinitially to identify the set of legal sources and then from these legal sources we extract semantic knowledge from which then we compose the meta-model.

Figure 2, shows the simplified meta-model in order to support the construction of services and legal ontology.The term legal ontology is usedbecause the concepts extracted are from legal documents.This meta-model is inspired and adapted from[2], [4], [5].It defines the key concepts necessary to link the ICT platform servicesto the organizational context fragment and to link services to scenarios. A service is defined by a name, a type, a description, and a goal. When we describescenarios, organizational context should be taken into account,as it would be meaningless to formulate options thatare contrary to the organizational context. A Scenario is definedby name, a context and situation description. The seniorlife and quality issues are specified, the specific conditionsand options for seniors are also specified when wedefine a scenario. An organizational context fragment canbe associated to one or several scenarios. A scenario can beconcerned by one or more organizational context fragment.A stakeholder can be concerned by one or more scenario.

A scenario for its specification can involve one or morestakeholder. The entity "Service - OCF" in this meta-modelexpresses a many-to-many relationship between the entity"Services" and the entity "Organizational ContextFragment (OCF)". An organizational context fragment can bedefined on one or several services. A service can be associatedto one or several organizational context fragment. Thereare three categories of organizational context:

- Standards and international norms.
- Ethical issues.
- Regulations and laws.

The concepts "Role" and "Rules" are explicitly defined in[4].A "role" represents a set of necessary responsibilities, authoritiesand capabilities, expressed in laws, to perform theexecution of the activities of the development process orto watch the execution of activities performed by the otherroles [4]. The "rules" are used to help the organizations tobetter achieve goals, communicate between principals andagents, between the organization and interested third parties,demonstrate the fulfillment of legal obligations, operate more efficiently, perform analysis on cur-rent practices. Consequently,rules are very significant because they guarantee theconformity of services with the legal framework [4].

2.4. Meta ***model in terms of OWL***

The meta-mode composed above (see Figure 2) has a very important role for ICT platform and it is related to the straight functionality of the platform. Basically, our generalintention to translate any meta-model in terms of ontological web language (OWL), is to adapt it with the technological requirements of the platform, defined previously. Also, thismodel could be integrated into the relational database model or other software solutions if there is needed for technical reasons to use the relational database model in the context of a platform.

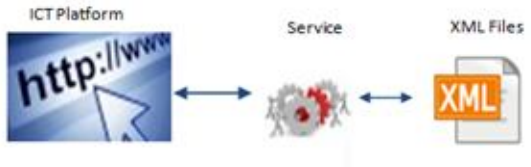

Fig.3. Technical architecture for linking of ICT platform and legal module[1].

Figure 3, represent the relationship between user interface and the legal module which is composed from service and set of OWL (XML) files.
So we make this translation into ontology web language(OWL) in order to make matchmaking of subjects or tasks,e.g., for posted job offer in platform, the process of matchmakingenable validation tasks with the legal framework inthe context of ICT platform.
The authors from [6], have represented ontological datamatchmaking framework which basically is used to calculatethe similarity between data elements, e.g. competency, function,person, tasks, and qualification based on competencyinformation.According to [6], Semantic data matching plays an importantrole in many ICT platforms. In semantic data modelthere are developed modules for interpreting and comparingwhich together make use of a library of matchmaking algorithm.
The matchmaking algorithm have access to the datamodel via API written in any programming language. Thedata can be described and interpreted in different natural languageand this multilingualism improve the usefulness of the ICTplatform (in our case of ICT Platform we have many stakeholder and many languages). From [6] we see that there are several ontologybaseddata matching algorithms:

a) String matchmaking which are useful to identify data objects e.g. competencies and qualification.
b) Lexical matching techniques which are useful to identifydata objects, by using linguistics to improve matchmaking.The techniques used are: tokenization and lemmatizationor using terminological database structured ontologically.
c) Graph matchmaking techniques which are used to calculatesimilarity between two given objects and also to findrelated objects for given objects [6].

The validation of compliance rules of legal and ethical issues issupposed to occur by selecting some key words provided byusers for example when they post any offer in ICTplatform and we make the link between offer and law regulationrelated to offer by using the matchmaking (any of algorithms above) agents services.The legal service will make the validation based on the XMLfile which is the technical expression of meta-model as it ispresented in the Figure 2,or any other meta-model.
So, we usethe ontology to define legal constraint and other regulationsin order to make validation of compliance. By using this methodology of work, we see that it is very useful to use theconcept of OWL to make the validation of compliance (seesection 4, for more details).
The validation is semi-automatic and as exception it willthrow a message which notifies the user that the particularactivity is not in compliance with legal, ethical or any regulatoryprocedure.

III. TRANSLATION THE META-MODEL INTO OWL

This section will describe the techniques for translation meta-model into OWL[2], and initially we introduce somebasic concepts of Semantic Web Technologies.[3]

3.1 Web Ontology Language - OWL

The Web Ontology Language - OWL is an international standard which is used by application for encoding and exchangingontology instead of just presenting information to humans and is designed to support the Semantic Web. Giving the information in an explicit way that machines can processit in an intelligently way defines the concept of Semantic Web [7]. The term Semantic Web refers to W3Cs vision ofthe Web of linked data.As it is specified in [7] the SemanticWeb allows user to provide formal definitions for standard terms they create.For example, from a semantic web search engine we may retrieve the information that, a ”particular-LawName” matches a query for ”Data Protection Law”.
By everyday usage of the web we see that there is lots of data that we use through the web and these data are not part of the web,e.g. checking the bank account statementon web, seeing appointments in a calendar etc.But, if I want to see the bank account statement lines in a calendar, actuallythis will not be possible because there is no web of data, so each application manage its ”own” data by itself[4].
The Semantic Web is Web of data. The technologies of Semantic Web enable people to create data stores on the Web, build vocabularies and write rules for handling data.
The linking of data is empowered by technologies such as RDF,SPARQL,OWL, and SKOS[5].

[1] Image sources:
http://www.cargobull.com/uk/Service-Partners-Service-Partner-Support_87_277.html
https://www.behance.net/gallery/10468401/XML-Icon

[2] http://www.w3.org/standards/webarch/metaformats
[3] http://www.w3.org/standards/semanticweb/
[4] http://www.w3.org/RDF/FAQ
[5] http://www.w3.org/standards/semanticweb/

Linked Data - The linked data is the main intention ofSemantic Web is all about.RDF provides the foundation forpublishing and linking your data.

Vocabularies - Defines the concept and relationship todescribe and represent an area concern. The role of vocabularieson Semantic Web are to help on data integration anddata organization by using mainly OWL.

Query - In the context of SemanticWeb,query is used toretrieve information from the Web of Data[6].

SKOS - A common data model for sharing and linking knowledge organization systems via the Web[7].

The OWL is an ontology language for Web. It is designedto be compatible with extensible markup language(XML) also with W3C standards. The OWL extends ResourceDescription Framework(RDF) and RDF Schema,so generally from syntactic point of view an OWL is avalid RDF document such is well-formed XML document.From semantic point ofview, OWL is based on descriptionLogic(DL) which are family of logics that are decidable fragmentsfor first-order predicate logic (FOL) [7].

Table 1. Example of DL

FOL	DL
classes	concept
property or predicate	role
object	individual

Classes - represent set of resources,e.g. Law,Person,and Flower etc.

Properties - In OWL we have two type of properties:

Object properties which specify the relationship between tworesources, see Figure 3, and data properties (also called attributes)specify a relation between a resource and a data typevalue.

Individuals (or instances) - used to express the semanticsof classes and properties. Example, individual a: *John*can be used to represent a particular person, so the personis concept, (*a:Person a:John*), or *Tulip* is instance of class*Flower*. An example which elaborates the relationship betweentwo resources is presented in Figure 4. In this examplewe express that each Personality Profile has data whichcorresponds to Personal data[8].

Fig.4.The relationship between two resources.

[6]http://www.linkeddatatools.com/querying-semantic-data
[7]http://www.w3.org/standards/
[8]http://www.linkeddatatools.com/introducing-rdfs-owl

3.2 The Protege - Implementation tool

As a tool for implementation of meta-model (or ontology) we use theProtege, which is an open source tool. It is very useful to construct domain models and also knowledge based application with ontology.

The Protege, can work in a desktop mode and also in web mode, and it provide high level of interface configuration which makes this tool suitable for bigenersand experts also.RDF/XML, Turtle, OWL/XML, OBO, and other formatsavailable for ontology upload and download[9].

The exampleof XML structure generated from Protege for meta-model is presented in Figure 5.

```
<!--
 // Classes
 -->

    <!-- http://www.semanticweb.org/user/ontologies/2015/5/untitled-
ontology-16 EthicalIssues -->

    <owl:Class
rdf:about="http://www.semanticweb.org/user/ontologies/2015/5/untitled-
ontology-16 EthicalIssues">

        <owl:disjointWith
rdf:resource="http://www.semanticweb.org/user/ontologies/2015/5/untitled-
ontology-16 RegulationAndLaw"/>

    <!--
     // Object Properties
     -->
     <!-- http://www.semanticweb.org/ user/ontologies/2015/5/untitled-
ontology-16#hasEthicalIssues -->

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/
user/ontologies/2015/5/untitled-ontology-16#hasEthicalIssues"/>

    <!--
     // Individuals
    -->
    <!-- http://www.semanticweb.org/ user/ontologies/2015/5/untitled-
ontology-16#Adaptation_Date -->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/
user/ontologies/2015/5/untitled-ontology-16#Adaptation_Date">
```

Fig. 5. Example of XML structure generated from Protege for meta-model.

OWL-Class	object properties	data properties	individuals
EthicalIssues		-	
EthicalIssuesReference	hasEthicalIssues	-	AnonymityAndPrivacy
OCFragmentReference	hasService	-	-
OrganisationalContextFragment	hasRule	-	-
OrganisationalContextOCF	usesOrgContext	-	-
OrganizationalContext	hasEthicalIssues	-	-
RegulationAndLaw	-	-	Name
Role	-	-	-
Rule	-	-	-
Scenario	-	-	ScenarioName
ServiceStakeholders	-	-	TypeSponsorSupport
Service	useOrganisation	-	ServiceName
Stakeholders	hasService	-	Switzerland
StandardAndInteratNorms	-	-	-
StandardsNormReferences	hasStandInterNorm	-	-
StandardsNormsRef	-	-	-

Fig. 6. Example of translating meta-model into OWL

[9]http://protegewiki.stanford.edu/wiki/WebProtegeUsersGuide

Note: In Figure 6, above there is made a representationat least one object properties,one data properties,one individualrelated to object.

IV. EXAMPLES

As we have seen from the section 2.4 and based on [8]we can translate any model into OWL (XML) file, from therethen we can use for technical purpose.
In context of validationof legal and ethical issues, the model represented in section 2.3, Figure 2, is not enough to cover all the rulesextracted from laws but as it is mentioned in section 2.3 itdefines the main concepts necessary to link "Services"to the organizational context fragment and to link servicesto scenarios.So, the problem of validation is muchmore complex, it should be considered carefully and sometimesit needs expertise to make right implementation and tovalidate the rules within it. The validation of rules which areimplemented into OWL (XML) file are made from experts infield of laws and regulations. For our case, we have severalmodels which are translated into OWL (XML) file based onrules extracted from concepts like employment contract, jobseeker, job offer, data protection, etc. Below we will presentone example which is the scenario of the job offer in the contextof ICT platform.
On the ICT platform we suppose that we havemany offers and one of the offer posted by any end user ororganization ,for job offer:

"Need a worker to work in garden during Sunday".

From the ICT platform we try to make link betweenJob offer posted from end user or organization and legal framework by using the concept of matchmaking (Section2.4). We know that the law is strict and the supposedrules from the law are extracted as below :

1.The law allows to work during Sundays in garden;
2.The working time should be specified by number of hours,e.g. 4 hours;
3.The starting time should be specified in order to classifyit as day work of night work (in any case);
4.The contract type should be specified, e.g.temporary or fixed-term;

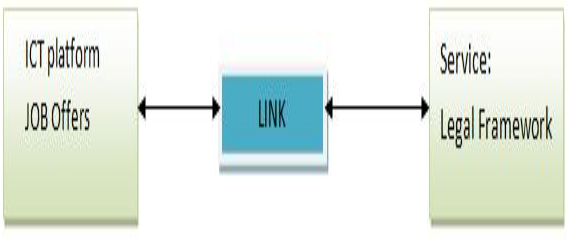

Fig. 7. The link between ICT platform service and legal frameworkservice:

The rules above in our ontology are translated in terms of axioms. Before, we introduce all necessary concepts as class and then for each class we introduce instances (individuals),e.g. instances for class **DayWorks** are"07:00AM -16:00PM" or "08:00AM - 17:00PM", etc. , or for subclass**TemporaryContract** of class **Contract**, the instances ,e.g. "three weeks", "one month" , "three months", etc., seeSection 3.1 for more details about OWL (XML) properties.
In terms of axioms we introduce the rules which are definedin law as above by using the notion of description logic. Thefirst rule in terms of axiom would be:

Garden*hasWorkingDays*some**WorkindDays**

The concept Garden represents any instance of work ingarden, theWorkingDays represent all instances of days e.g.,from Monday to Sunday, and the concept of axiom allow thework in garden in any day of the week.
In same manner is composed the axiom for second casethat the working time should specified, like:

WokingTime*workTime*some**PartialTime**,

in case of partial work and

WokingTime*workTime*some**FullTime**,

in case of full time work, and as instance we specify the numberof hours.

The third case is composed as axiom to define the startingtime in order to classify the work as day work or nightwork:

TimeSpecification*hasStartinTime*some**DayWork**,

or

TimeSpecification*hasStartinTime*some**NightWork**

The fourth case is composed as axiom to define the contracttype for any work:

Contract*hasType*some**FixedTermContract**,

or

Contract*hasType*some**TemporaryContract**

Then after defining the rules we use Query to retrieve theinformation for offer posted on ICT platform service. Based onexpression of offer the query will respond to the service aspositive answer which mean that the offer posed on service iscompliant with law module or negative answer which meanthat the offer is not in compliant with law and the message inthis

step will be to notify the user to change the expressionof offer, e.g. from*"Need a worker to work in garden during Sunday"*to *"Need a worker to work temporary in garden during Monday, starting time from 14:00 PM to 16:00PM"*.

Note that, in order to make it simple to understand for the readers, we have used some easy examples to define ruleswhich are from laws by using the simplest axioms. The process,in general, is much more complex and usually it is necessaryto present other concepts which make able the rules to bedefined, so the composition of axioms will be much harder.

CONCLUSION AND FUTURE WORK

Regarding the topic of compliance of services with the legal framework and ethical issues we consider that the challenge of implementing the compliance rules remain still an issue to be treated in order to tend the perfections of these issues. The methodology presented by us to work with is considered to give a clear frame on implementation forlegal and ethical compliance. The benefits to work with the concept of the OWL(XML) are because when the changes occurs in law, ethical issues or any regulation, then it is easier to change the OWL (XML) files, to add new concepts, to remove concepts or manage new rules.We consider this methodology, a step forward on maintenance of the platforms in relationship with legal framework.
Our next research step will be the analysis for improving service scenarios based on the compliance rules.

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