

# The new strategy to develop scenarios in compliance with legal and ethical issues

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## Abstract

The Service scenarios have a crucial role in the overall functionality of Information Systems (IS). They should be treated and examined very carefully in order to fulfill the end-user expectations and the overall platform behavior by itself. To have a qualitative scenarios it is not enough to treat only the user expectation but also these scenarios should be in compliance with legal and ethical issues otherwise it will be meaningless to have scenarios which are in contradiction with legal and ethical aspects. In this research document, we propose an approach to develop service scenarios in an early stage in order to start the development phase without any concern about compliance rules.

**Keywords:** Scenarios; Compliance; ICT platform; Legal Source

## 1. Introduction

The scenarios describe the events or actions which are planned to happen in the context of the information system (IS). The actors involved in scenarios, read the information, interpret it and make a decision based on these scenarios, according to [1]. The scenarios are often used for discovering requirements [6]. In order to develop a more effective scenarios process, there is a need to have a better understanding of these processes and their impact on requirements discovery [6]. As it is specified in [7], the scenarios and use cases are an efficient technique to discover stakeholder requirements. The requirements validation is an important task. The requirement process ensures that the set of the requirements collected is correct, it is completed as it is expected and also it is consistent [8]. While we compose the service scenario we should take into account the constraints which stemming from legal, international standards and ethical issues [2]. The compliance to legal regulation, internal rules and regulation or international standards is becoming one of the most important conditions to be considered [2].

The compliance represents the set of formulating rules, which could be checked during or after execution the business process [2].

The research presented in this paper is made in the context of European project (<http://sponsor-aal.eu/>), in the domain of Ambient Assisted Living (AAL). The main intention of this ICT platform is to offer facility in posting, browsing

and exchanging basic information between competence-offering seniors and search-based requests, from competence-demanding organizations from the public, private and voluntary sectors. We use it as a case study in order to explain our methodology for developing scenarios of services with compliance rules.

In the context of this project, there are involved, several stakeholders which cooperate together in order to compose the service scenarios. Since they are hosted in different countries, the gathering of user requirements as a for the final purpose of the project, the diversity of these scenarios is not absent even when they describe sometimes almost same situations. It is well known that the events on scenarios probably come from end user needs, private or public organization which means that, they trigger actions that imply the legal and ethical aspects.

As a strategy we proposed, initially, we define a specific scenario or select any scenario which is already defined, then we analyze the legal sources, ethical issues or standards and international norms related to the scenario topic, then based on the extracted knowledge from legal sources and ethical issues we conclude that we develop a part of the scenario in compliance with legal and ethical issues.

The scenarios which are already predefined, need to be in compliance with laws of the host country of service also with the international standards.

This paper is organized as follows. Section 2 describes the proposed methodology to develop scenarios in compliance with law, ethical issues and standards and international norms. In the subsection 2.1, there is presented the overall organization of the service - scenarios - organizational context of the ICT platform. In subsection 2.2, there is presented a practical example. In Section 3 we present the architecture of the service compliance to support the compliance achievement. Section 4 gives a detailed example and some techniques to support the scenario compliance. Finally, we have Section 5 which expresses our conclusions and future work.

## 2. Methodological Approach

Our methodological approach proposed in this research is composed of four main steps:

- defining or selecting the specific scenario;
- analyzing the legal sources;
- scenario analyzing and specifications;
- constructing compliant scenarios.

On our strategy, initially we define a specific scenario with the contribution of several stakeholders in our case or we examine an existing scenario which is already defined by any stakeholders. The scenario which is already defined, concerning the purpose of fulfillment of user needs, based on the services associated with this scenario, we select a relevant legal source or ethical principles, or any standard or international norms under the name "Universe of Discourse". By analyzing the "Universe of Discourse", there are selected the basic rules which define for us the control objectives<sup>1</sup> for the scenario which is examined. There are several techniques to extract and define these control objectives based on scenario specification [11]. In general, the control objectives are taken directly from law or they are formulated as a single control objective from several law fragments. An example of control objective is as below:

*"personal data carrier control: unauthorized persons must be prevented from reading, copying, altering or removing data carriers"<sup>2</sup>*

Just after we have selected our control objective (as our second step of the methodology), from selected legal source related to our scenario then for these control objective we examine if our selected scenario has any activity or general behaviour is against these objectives (as the third step of our methodology), then this scenario is classified as non-compliant, and it should be redefined. There are some recommendations which stem from our third step of our methodology and those recommendations should be taken into account from the user requirements officers in order to complete compliant user requirements set. Subsequently, taking into account the rules which are from previous steps imply on the construction of compliant scenarios which is fourth step of our methodology.

For the scenario which is not defined already, but it is in process of definition, our methodology allows to select coherently the legal sources, ethical issues or any regulatory framework depends on the scenario treatment subject, and then while the scenario is ongoing to be defined we follow the methodological steps describe above, finally to construct a compliant scenario. This mechanism of defining compliant scenarios is known as *compliance by design* [12]. The

figurative expression for this mechanism is given in Figure 1.

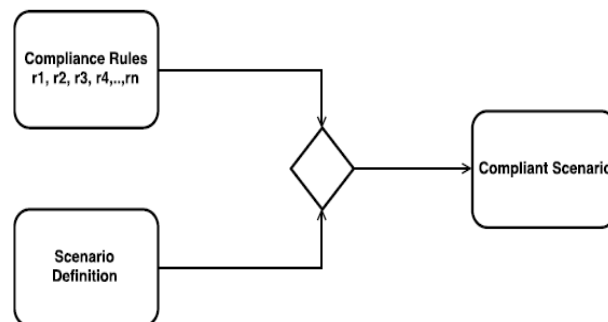


Fig. 1 Constructing compliant scenario.

While analyzing the legal source we extract also ontological concepts, ontological role and ontological business rules [4]. From this extracted knowledge we formulate the rules which stem from "Universe of Discourse", then we make implementation for the purpose of technical support of the platform to achieve compliance. About the technical support issues, more details are presented in section 3, which is for technical support of the service.

In the Figure 2<sup>3</sup>, there are presented all the entities of methodology and their interconnections.

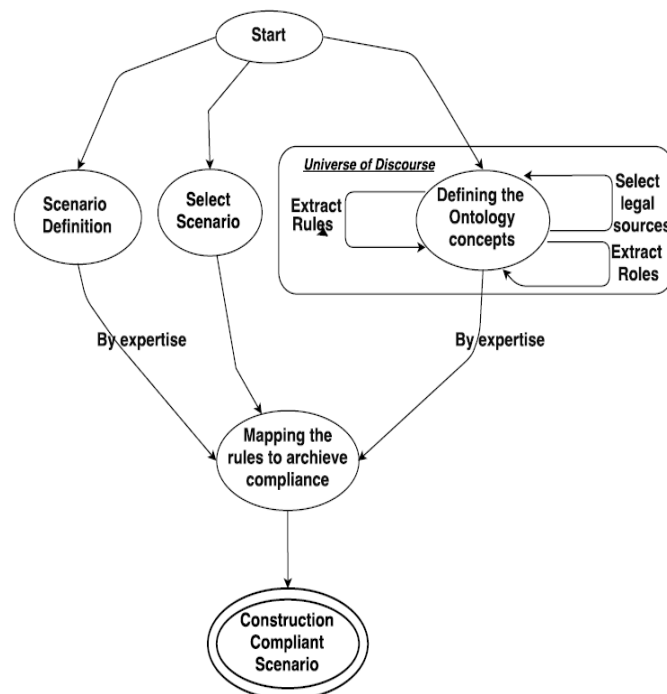


Fig. 2 The process of developing compliant scenarios with legal sources and ethical issues.

<sup>1</sup> control objective or legal rules

<sup>2</sup> <https://www.admin.ch/opc/en/classified-compilation/19930159/index.html#id-ni1>

<sup>3</sup> Figure source: Abdelaziz Khadraoui, University of Geneva, Institute of Services Science(ISS)

## 2.1 The description of the meta model to support the methodological approach

In the Figure 3, there is presented the meta-model which describes in a general way the interconnection of the components while we are building service. This meta-model is composed based on research done in [3],[4],[5] and [2].

The entity "SERVICES" is defined by its name, the type of services it provides, its description and the goal of the service. The service could be provided and developed from any stakeholder from another country.

The entity "SCENARIOS", has as attribute the scenario name, the situation, and its context description, the intention why the scenario is composed. All scenarios are related to the services provided and depend on the specific situation they will be used.

The Stakeholders contribute to the design of one or several scenarios.

The scenarios are related to the notion of "ORGANIZATIONAL CONTEXT", which provide scenarios with rules and regulations in order to have scenarios which are in compliance with laws, international norms and ethical issues. The notion "ORGANISATIONAL CONTEXT" defines the rules and regulation which originated from "Regulation and Laws", "Standards and International Norms", and "Ethical Issues". The entity "Regulation and Laws" is defined by attributes like the name of the law, its adaptation date, effective date and the reference, while "Standards and International Norms", includes items for international standards e.g. ISO,W3C. The concept "Ethical Issues", basically includes the main principles of ethics and also it suggest other standards which are related to ethical issues.

The main intention of the meta-model presented here is to show the referential model of our work for service development and it shows the involvement of other stakeholders. As we have mentioned above many stakeholders cooperate to compose the scenarios for the service which will be provided by ICT platform. Then this requires validation of these scenarios in the context of legal and ethical issues.

## 2.2 A practical example to employ our methodology approach

In this section, we will cover practically first three points of our methodology which then suggest for us specific recommendations for construction compliant scenario. As we have described in Section 1, the ICT platform can be used from individual seniors and also from the organizations. A various type of organizations [9] are :

- end-user organizations for volunteer work;
- senior connected organization;
- organization that provides services which may include senior work;
- organization dedicated to promote or make use of senior occupation with diminished physical or cognitive capabilities.

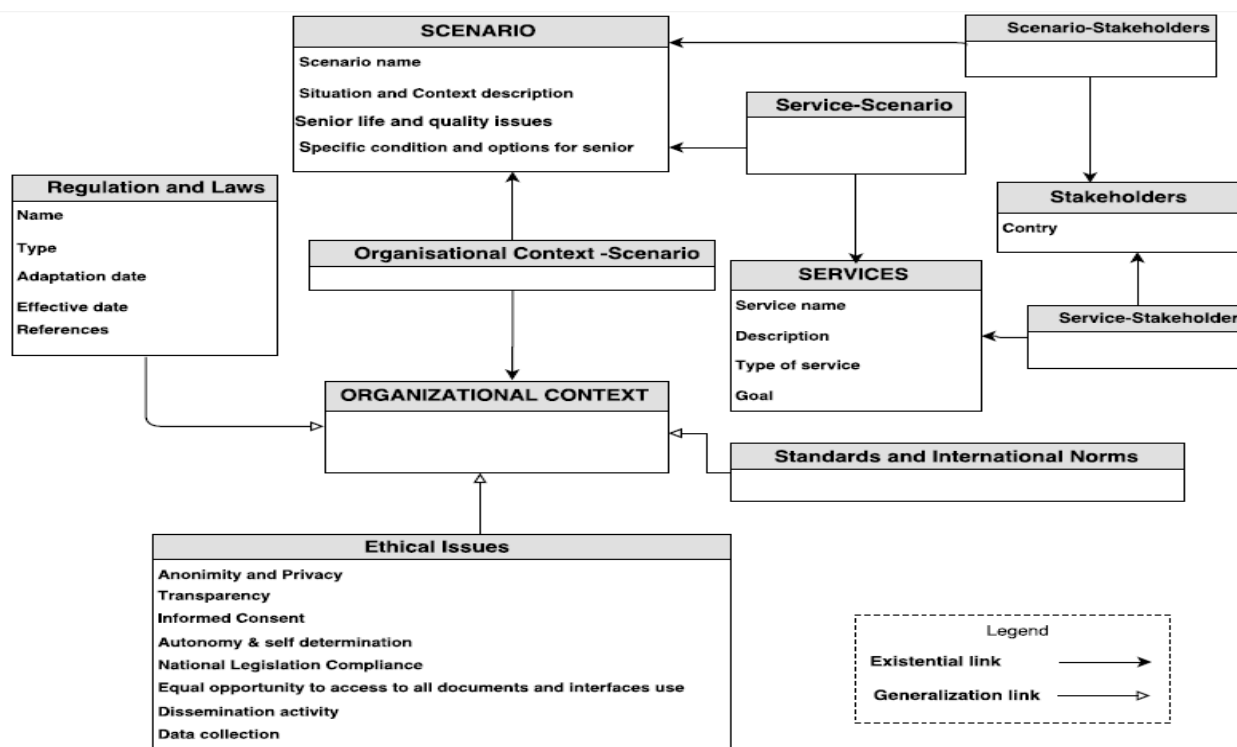


Fig. 3 The meta-model for service scenarios [9].

From these types of organization provided above, we have several stakeholders which work with these organization in a context to provide services for them by supporting these organization with ICT platform functionalities by trying to make an easy way of communication and exchanging daily information between these organization and persons (users). These stakeholders will provide for us various options for scenario definitions.

Suppose we have a scenario provided by an organization which is dedicated to promote the senior occupation for diminished physical or cognitive capabilities, and the description of the scenario is presented in Table 1.

Table 1: The scenario description

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario name</b> | Senior occupational for diminished persons                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Goal</b>          | Promote or make use the senior occupational with diminished physical or cognitive capabilities.                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>   | There is considered that there are many organizations (or associations) which promote and support the senior occupational for persons with diminished physical or cognitive capabilities. These organizations help these persons by associate them with enterprises who are searching for senior expertise. The seniors who could be employed probably would have to be trained to achieve the satisfaction, expertise level or another case is that the senior could be employed directly by the enterprise. |

To elaborate schema from Table 1, in the context of our case study for an ICT platform, a figurative explanation is presented in the Figure 4.

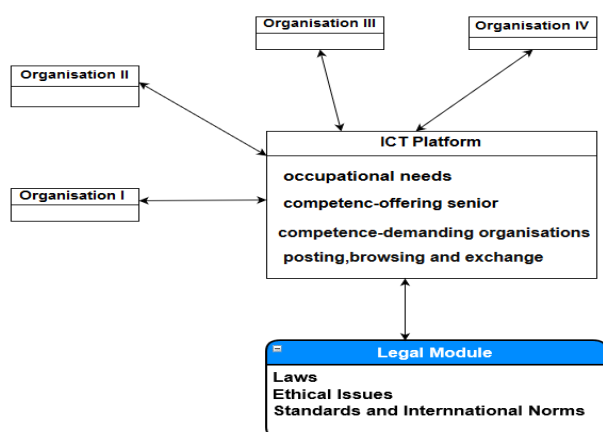


Fig. 4 The interaction between organizations and ICT platform.

The meta model presented in Figure 3, support the ICT platform infrastructure (product model) in order that the scenarios to be in compliance with legal, ethical and standards and international norms. From Figure 4, we have several organizations which, in this case, we suppose they are to support the persons with diminished physical or cognitive capabilities. These organizations use the ICT platform to find a training for persons with diminished physical or cognitive capabilities, to find new employment contract or volunteer work, to search for any social event or cultural activities in which these persons can participate. All scenarios (events, actions) performed from organizations should be in compliance with Legal Module(Laws, Ethical Issues, Standards, and Internationals Norms(see Figure 4)), in order to avoid any issue which is against these regulations.

The concrete example is that if any organization mentioned above proposes an employment contract to an enterprise, all the elements of the contract should be in compliance with the laws, ethical issues and standard and international norms. If the elements described on the contract formulation between the employee and enterprise are not compliant then the platform will notify the enterprise that the terms of the contract should be modified or removed. This will ensure that, the legal issues are considered and the platform behavior is compliant with law and ethical issues.

Another example would be organizing the social and cultural activities organized by any association(organization) it should meet all ethical principle in order to avoid any case when the cultural activity is held in a theatre which is not accessible for handicap persons, so this is an issue of ethics, which should be respected.

The validation is semi-automatic and as an exception, it will throw a message which notifies the user that the particular activity in the ICT platform is not in compliance with legal, ethical aspects and standards and international norms [2].

Since we have several services stemmed for the selected scenario from the Table I, because we could have several different cases, we proceed to the second step and analyze the legal sources.

First, we analyze the local legal sources and in this case in Switzerland, there are several measures to promote the integration of people with disabilities and there are presented as in table below:

Table 2: Legal sources for persons with diminished physical or cognitive capabilities in the context of Switzerland

| Regulations              | Description                                                                                                                    |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| The Federal Constitution | The Federal Constitution sets out the basic principles of disability legislation.<br><br><b>Art. 8</b> Equality before the law |

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | <p>The law shall provide for the elimination of inequalities that affect persons with disabilities.</p> <p>Art. 112c1 Aid for elderly people and people with disabilities</p> <p>The Confederation shall support national efforts for the benefit of elderly people and people with disabilities. For this purpose, it may use resources from the Old-age, Survivors and Invalidity Insurance.</p> |
| Federal Law on Invalidity Insurance | <p><b>Art 18.</b>Work-experience allowance</p> <p><b>Art 28.</b> This article concerns the auxiliary aids useful for disabled persons</p>                                                                                                                                                                                                                                                          |
| Several Cantonal laws               | <p>There are also several Cantonal laws which aim to promote the entry into employment of people with disabilities through incentives such as financial support, tax deductions and grants [10].</p>                                                                                                                                                                                               |
| Law on unemployment insurance       | <p><b>Art.64</b> a temporary employment programs, professional training courses and motivational semesters</p> <p><b>Art.65</b> work-experience allowances</p>                                                                                                                                                                                                                                     |

The following provisions of the labor contract law are also applying in the case of the employment of people with disabilities<sup>4</sup>.

Table 3: The provisions of the labor contract law

Art. 321a, code of obligations, duty of care and loyalty.

Art. 321b, code of obligations, disclosure and hand-over of benefits received and work produced.

Art. 321c, code of obligations, overtime.

Art. 321d, code of obligations, compliance with general directives and instructions.

Art. 321e, code of obligations, employee' sliability.

Art. 327,327a, 327b, 327c, code of obligation, work tools, materials and expenses.

Art. 328 and 328b, code of obligations, protection of the employee's personality rights.

Art 329, 329a and 329c, code of obligations, days off work, holidays.

Art 330, code of obligations, other duties, Security.

Art 330a, code of obligations, reference.

Art 330b, code of obligations, duty of information.

Art 332, code of obligations, right to inventions and designs.

Now, since we have the legal sources selected, we make the analysis of the legal sources related to the scenario described.

The procedure of analysis is characterized by analysis the part of the laws which are closely related to scenario specification. As an example, suppose that in the law we have a precise description that it is not allowed to work more than six hours per day for persons with specific abilities, then if the scenario specifies that the person should work more than six hours per day for this specific work, than this is against law. Since the scenario is not in compliance with the law, it cannot be implemented as it is described now, so it should be changed and instead of specifying the work time as six hours per day, there should be specified in the scenario description that the persons can work not more than six hours per day. In this way we examine each scenario with legal source or ethical issues, depended in the scenario description and its relation with the laws and ethical issues.

After this step, we go forward and extract the semantic concepts which are stemming from the legal or ethical documents and then we map these concepts into the ontology. By using these concepts mapped in the ontology we have the possibility to create the rules which determine the behavior of scenarios and its activities by supporting the ICT platform with the technical aspects to avoid any noncompliant situation [2]. In section 4, there is presented a detailed example which explains the construction of the compliant scenario supported with technical components. The scenario which is examined and developed here treats the problem of working in the garden during the Sunday. Suppose we have scenario, "*Need a worker to work in garden during Sunday*". From the ICT platform, we try to make the link between this job offer posted from the end user or organization and legal framework.

<sup>4</sup>Federal Act on the Amendment of the Swiss Civil Code ((Part Five: The Code of Obligations)

### 3. Architecture of Compliance Web-Services

The following figure depicts the integration of the different services mentioned in the previous section.

The architecture is mainly divided into three layers:

- The user interface layer, which contains the services directly linked to the user;
- The compliance engines layer, which is responsible to perform all the compliance processes described in section 4;
- The storage layer, which stores the ontologies, taxonomy and results of checks of compliance.

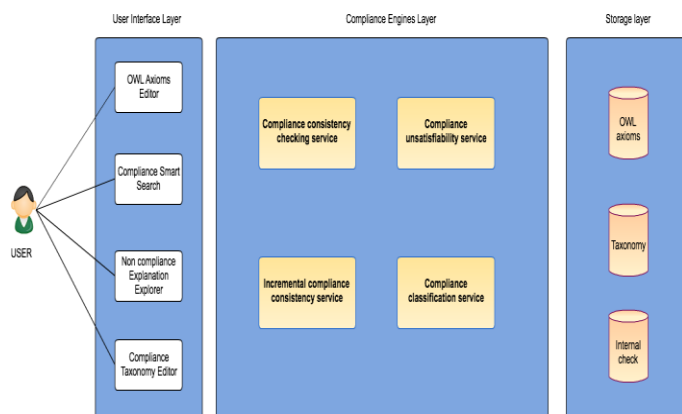


Fig. 5: High-level view of the platform layers.

The first layer is composed of the following components:

- OWL Axioms editor: this component enables a user to create, edit and delete axioms, expressed with OWL language;
- Compliance Smart Search: this component is the graphical interface for searching compliance scenarios;
- Non Compliance Explanation Explorer: this component: this component gives the ability of the user to see the explanation part of the processes handled by the compliance engines layer;
- Compliance Taxonomy Editor: this component proposes a graphical interface for creating and editing their own taxonomies related to their expertise.

The third layer contains the different databases used by the platform. According to the previous section, we can identify three databases: one for storing the axioms in OWL format, second for storing the taxonomies of the experts and the third (which can be embedded into one component) is for storing the results of the compliance checking processes.

Then the main layer is the layer called “compliance engines layer”, which contains the main components assuring the compliance of the new or existing scenarios, according to

legal and ethical concerns. We can distinguish four components: 1) Compliance consistency checking service, 2) Compliance unsatisfiability service, 3) Incremental compliance consistency service and 4) Compliance classification service. From an architectural point of view, these components could be distributed in the cloud (private or public), with possible legal restrictions on the storage of the data.

### 4. Ontology-based Inferences Techniques in Support Compliant Scenario Construction

As explained in the preceding sections, the output of the first three steps of the method are ontologies concerning scenarios (and services) and compliance rules. However a semi-automated support must be given for assessing the compliance of the proposed services by using the models produced by the first three steps of the method. This support is based on inference engines based on the semantic web technologies, such as, OWL2 reasoners (e.g. Pellet, Fact, or Racer), and rule-based inference engines (e.g. Jena).

When given a set of OWL axioms, the main functionalities of the reasoners that are often used are: consistency checking (i.e. does the complete set of OWL axioms has at least one model?), satisfiability (i.e. which are the classes that are always empty for all models?), subsumption (or classification, i.e. for each couple of classes, is one included in the other for all models?), and realization (i.e. for each class, what are their members?) [14]. Other useful services are the explanation (of inconsistencies, of unsatisfiability, of subsumption, or of realization), and the efficient reasoning with incremental modifications of OWL axioms. Rule-based engines specific for semantic web technologies, use the results of those reasoning services for making rule-based inferences on specific instances declared with the OWL axioms, and very often, create new instances. Compliance is often associated with “yes/no checks” against regulatory rules [15]. This basic compliance web-service can easily be implemented with the realization functionality: one use the set of instances defining a scenario and test against the classes defining the regulatory rules that apply to the scenario.

Additional compliance support web-services are needed when creating a new scenario, or when searching for scenarios, or when managing non-compliant scenarios [16]. In the rest of this Section we detail the compliance web-services that are proposed in the platform, and for each of them, a) we sketch how those services are formalized in OWL2 (in the OWL Functional Syntax which is a standardized syntax that is more easily readable by humans), and b) we explain how the functionalities of the reasoners and rule engines are used to implement them.

#### 4.1 Web-services for consistency analysis when creating compliance rules

First of all, one has to make sure that the rules used for compliance checking are consistent, and accurate.

When compliance rules are created in the platform by inserting OWL axioms representing them, a web-service has to check their consistency with the other rules (i.e. their OWL axioms). So, that first web-service, called *compliance consistency checking*, uses the consistency functionality of reasoners in order to check the consistency of different subsets of rules, of domain knowledge, and/or of scenarios[17]. For instance, one can check just one rule, a subset of rules, or all rules. Other cases will check a mixed set of rules and some domain knowledge and/or scenarios. That *compliance consistency checking* web-service is to be used in conjunction with a web-service that allows defining and storing interesting subsets according to users' expertise: it is called the *compliance taxonomy* web-service. (To simplify the descriptions of the ontology-based web-services, we use the term "taxonomy", although any other kind of graphs of concepts or of set of axioms are addressed). The *compliance consistency checking* web-service will also use another web-service that will provide incremental checks. That web-service, called *incremental compliance consistency manager*, will store all results of the checks, and when some rule is modified, it will trigger the compliance consistency web-service to check again all sets that are related with the modified rule. This allows an efficient incremental consistency check mechanism. Note that the incremental reasoning functionality of reasoners can be used in the *incremental compliance consistency manager*, by saving and restoring the state of the reasoner.

Resolving non-compliance is a difficult problem [18]. As the platform should be used by non IT experts, we have to provide an easy way for finding most of the inconsistencies. One way is to use decomposition strategies. Decomposition strategies have proven to be very useful in case of process-based compliance as can be seen in [15] and [20]. In this work, the decomposition must be close to the end-users experience. Two kinds of decomposition will be used for that purpose. A first decomposition will be made with layers of compliance rules. Complex rules are made of simple concepts declared in simple classes. Those classes are elicited during the analysis of the regulations. Users of organizations will create and select the classes according their expertise, using the *compliance taxonomy* web-service. Note that this is different from the case of using that web-service with sets of axioms or axioms as explained in the preceding paragraphs. Then the classification functionality or reasoners can be used for showing a kind of taxonomy of the different cases by using the *compliance classification* web-service. Note that the classification is relative to a subset of axioms and declarations, as found in the compliance taxonomy web-service. Then when inconsistencies are detected with the *compliance consistency checking* web-service, one can see the classes that are in conflict in the taxonomy generated by the *compliance*

*taxonomy* web-service. Note that inconsistencies can also be found between sets of axioms and/or classes shown in the classification when using the *compliance consistency checking* web-service. Of course, the *incremental compliance consistency manager* will also increase the efficiency of those checks.

A second decomposition can be defined by the same end-users: they could decompose a problem (e.g. a rule) into sub-problems. Decomposition by cases is a well-known problem solving strategy. For defining the decomposition one can use (amongst others) the OWL2 class operators `SubClassOf`, `ObjectUnionOf` or `ObjectIntersectionOf`. An instance of class to be defined by the end-user would concern the regulations that are related to the noise produced by occupations made in residential areas. One could identify the following cases: indoor or outdoor occupations, gardening or construction, week-end versus other days of the week. Then, like for the first decomposition, one can use the classification functionality of reasoners implemented in the *compliance classification* web-service, to get some taxonomy of different cases of regulations or parts of regulations and the sets of axioms that are related to those cases. The user-defined taxonomies and the reasoners-generated taxonomies are clearly identified in the *compliance classification* web-service. One has to check the inconsistencies that could occur when checking that user-defined taxonomy jointly with the reasoner-generated taxonomies. But in addition to that, a new web-service is used to analyse those taxonomies: this *compliance unsatisfiability finder* web-service. It is based on the satisfiability functionality of reasoners. That web-service can tag all cases (or any class) of the taxonomies as follows: 1) sample cases always exists, 2) sample cases never exists, and 3) sometimes cases can exists, or sometimes no case can exist, depending on specific situations of other cases (or class, or concepts). The first possibility points out "always cases", i.e. cases that should always be possible in any situation: for instance, written contracts for all jobs should always be a possible option in all laws. The second possibility points out "emptycases". This can used to detect problems with cases that should not be empty (for instance, it should be possible to define some cases in scenarios with impaired persons with gardening occupation), or to point out cases that should never exists (such as occupations with neighborhood nuisances).

It has to be noted that there are different impacts due to the different non-compliance cases. Some taxonomy of non-compliance cases has been defined in [19]. This is important, in particular for ethical issues. Indeed, ethical issues can be analyzed at before the execution of the scenario or service. But most of ethical cases that occur during the execution of scenario or services are unforeseen situations and needs a special treatment.

## 4.2 Web-services for consistency and compliance checking when creating (or modifying) scenarios

The activity of defining (or modifying) scenarios is very different from creating (or modifying) compliance rules. So, there must be different web-services for each case because the difference between the information that is managed by those web-services. However, most of the functionalities are similar and some factorization (abstraction) can be made in the design of those web-services. The main difference for scenarios is that there are two different sub-activities: first the consistency of scenarios (when considering the domain knowledge), and second, the compliance with compliance rules. We will not further detail those web-services.

All those techniques are useful for end-users analyze more easily the problems (e.g. inconsistencies, unsatisfactions, or wrong classifications) because warnings messages can be shown in the taxonomies in parts of regulations or simpler scenarios, or simple concepts.

## 4.3 Web-service for explanations in compliance analyses

An important web-service, called the *non-compliance explanation explorer* web-service, is to help end-users of the platform to understand why a compliance rule or a scenario is not compliant. Explanations about non-compliance should be given in order to provide the end-user with support for taking appropriate decisions about how to manage the non-compliant scenario as has been shown in [20] and [21]. In preceding paragraphs, it has been shown how to provide structured information into the taxonomies (which can also be more general graphs of sets of axioms, declarations, etc.). However, this does not give any clue on the kinds of the different sources of non-compliance. Indeed, there can be different explanations for non-compliance, and we will focus on the following ones: a) in the scenario some information is missing, b) some information has not the right type, c) some regulatory rule does not apply for that case, d) a part of some regulatory rule is violated (for regulatory rules applicable for that scenario).

For the first case, one has to define all mandatory information. For instance, in the case of gardening, one has to describe the days of the week when the job will be performed, in order to check against the law on neighbourhood nuisances. For the running example scenario we can check easily all instances must have defined a day of week for the job. So, one can check whether the data property `day_of_week` has a value defined by creating a class `Has_some_day_of_week_value` and defined with the axiom `EquivalentClasses( :Has_some_day_of_week_valueDataSomeValuesFrom( :some_day_of_weekrdfs:Literal))`. Then this can be used for any class to check, in particular for the `Job` class by

defining the class `Job_has_some_day_of_week_value` as follows:

```
EquivalentClasses(:job_has_some_day_of_
week_valueObjectIntersectionOf(:Job
:Has_some_day_of_week_value)). One can make more
precise information requirements by detailing the subclasses
of jobs, such as gardening.
```

For the second case, one has to detail the requirements on the type of information that have to be used in compliance rules. For the running example scenario, we can check easily all instances that are related to a `dayOfWeek` data type by creating a class `has_some_dayOfWeek_data` and defined with the axiom `EquivalentClasses( :has_some_dayOfWeek_dataDataSomeValuesFrom( owl:topDataProperty :dayOfWeek))`. Again, more precise information requirements can be detailed. For instance, one can use the data property `:some_day_of_week` instead of using `owl:topDataProperty`.

For the third case, the end-user has to split the conditions of application of the compliance rules, so that classes are declared for each elementary condition. Then compliance rules will be fulfilled when all conditions are fulfilled. For our running example, one could describe the condition of jurisdiction, in particular, where the rule applies (in country, county, or city), when it applies. Note that one could define OWL axioms such that the compliance rules contain those requirements, but it is better to separate those requirements in order to have more details in the explanation when a compliance rule is not fulfilled. Indeed, just one condition might be removed for the rule being fulfilled. In our case, one could just select days of weeks that are not during the wee-end.

For the fourth case, the end-user can also split the different constraints that are enforces by a compliance rule, just like this has been done for the conditions of applications of compliance rules in the third case.

Note that all those requirements that have been structured for giving better explanations are also axioms that can be checked with the *compliance consistency checking* web-service, the *compliance unsatisfiability finder* web-service. Moreover, those new axioms defined in the four cases should also be handled by the *compliance taxonomy* web-service and the *compliance classification* web-service.

The *non-compliance explanation explorer* web-service uses the explanation functionality of reasoners. This web-service is used always after activities made for consistency analysis when creating (or modifying) compliance rules, but also activities made for defining or modifying scenarios. During those activities, the *non-compliance explanation explorer* web-service will be used just after the use of the *compliance consistency checking* web-service, the *compliance unsatisfiability finder* web-service, the *compliance classification* web-service, or the *compliance taxonomy* web-service.

#### 4.4 Web-service for smart search in compliance cases

Other compliance web-services are needed, not at compliance rule or scenario creation time, but when searching in the database scenario of interest, or when managing the scenario in the database just like in [16] and [22]. Note that one cannot refuse to store a scenario just because it is non-compliant. The aforementioned compliance analysis web-services can be used to help make them compliant, but in an activity that occurs later in the processing of scenarios.

The *compliance smart search* web-service is very useful for managing non-compliant scenarios, but also to find applicable compliance rules or to find similar compliant scenarios. This *compliance smart search* web-service is based on the classification functionality of reasoners and on the *compliance taxonomy* web-service. The *compliance smart search* web-service allows defining specific user-defined views on the taxonomies. For instance, the end-user can decide to classify all non-compliant scenarios in a meaningful taxonomy so that the end-users can easily understand the best options to select in order to solve the non-compliance issues for those scenarios. Again, this will be done by defining specific classes to classify like for taxonomies of compliance rules or taxonomies of scenarios. However, in order to make more user-friendly the search mechanism in the different views and taxonomies, the end-users can incrementally define folksonomies. Actually folksonomies are often used to ease the access to documents by end-users. In our case instead of documents, it is the description text of compliance rules and the descriptive texts of scenarios that are considered. The compliance smart search will benefit from the correlation between the tags used for each view, the corresponding descriptive texts and the concepts used in the corresponding OWL axioms (in addition to the relationship with the users having created the tag with a folksonomy item).

In addition to that, the *compliance smart search* web-service collects and display statistical information about the number of compliance rules and/or scenarios related to OWL axioms or declarations, or related to folksonomy items.

Finally, with that structured descriptive information about compliance rules and scenarios, and also with that statistical information, the *compliance smart search* web-service provides a smart incremental searching mechanism, displaying the parts of the taxonomies or views that are most relevant according the partial definition of the search given by the end-user.

## 5. Conclusions and Future Works

The subject of scenario development which are compliant with legal aspects, ethical aspects, standards and international norms remains still one of the main challenges to consider in context of knowledge formulation and also technological support while we are creating an ICT

platform. The methodology presented above on this research paper is considered to give a clear frame on scenario development, compliant with legal sources, ethical issues and standards and international norms. The benefits to work with this methodology are because we can identify any service scenario which is not compliant, at an early stage, then we avoid the developing these scenarios which would be as non-functional at the end.

We consider this methodology, a step forward in scenario development for the ICT platforms in relationship with the legal framework and our next researches challenges will remain the validation of the scenarios activities of the ICT platform after they are already defined and constructed.

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