

SW4LAW 2014 and JURIX2014-DC

Semantic Web for the Law and Second Jurix Doctoral Consortium

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Preface

This volume contains the papers presented at “SW4Law 2014: 2014 International Workshop on Semantic Web for the Law” held on December 10th, 2014 in Kraków, co-located with the 27th International Conference on Legal Knowledge and Information Systems (JURIX-2014).

The two research areas of Legal Knowledge and Information Systems, and the Semantic Web are very much interconnected. The legal domain is an ideal field of study for Semantic Web researchers, as it uses and contributes to most of the topics that are relevant to the community. Given the complex interactions of legal actors, legal sources and legal processes, as well as the relevance and potential impact of decisions in the juridical and social processes of a country, it provides a challenging context and an important opportunity for groundbreaking research results. At the same time, Semantic Web formalisms and technologies provide a set of technical instruments which can be fruitfully adopted by legal experts to represent, interlink, and reason over legal knowledge and related aspects such as provenance, privacy, and trust. In particular, Semantic Web technology facilitates standards-based legal knowledge representation, which enables the possibility of legal information reuse over the Web.

Ontologies, knowledge extraction and reasoning techniques have been studied by the Artificial Intelligence & Law community for years, but only few and sparse connections with the Semantic Web community have resulted from these interactions. The aim of this workshop was to study the challenges that the legal domain poses to Semantic Web research, and how Semantic Web technologies and formalisms can contribute to address these open issues. This way, we promoted the use of legal knowledge for addressing Semantic Web research questions and, vice versa, to use Semantic Web technologies as tools for reasoning over legal knowledge. In particular, the workshop aimed at attracting submissions exploring the following topics:

- Modeling access policies to Semantic Web datasets
- Semantic Web and online dispute resolution and mediation
- Law and Regulations patterns of Social Web communities (such as Second Life, Facebook, or Twitter)
- Semantic sensor networks in lawsuits, crisis mapping, emergencies and stand-by forces
- Semantic Web techniques and e-discovery in large legal document collections
- Semantic Web technologies and opinion collection and analysis
- Legal content and knowledge in the Linked Data
- Knowledge acquisition and concept representation on annotations and legal texts
- Legal ontology process and management
- Legal reasoning and query in the Semantic Web
- Scalability issues in representing law and legal texts
- Analysis of provenance information to detect violations of norms/policies
- Expressive vs. lightweight representations of legal content
- Core and domain ontologies in the legal domain

- Theories, design patterns and ontologies in legal argumentation
- Time and legal content representation (texts, concepts, norms)
- OWL approaches to reasoning and legal knowledge
- Linking legal content to external resources
- Provenance, trust and metadata for authoritative sources
- SPARQL queries on large legal datasets
- Legal knowledge extraction using NLP and ontologies
- User-friendly applications and interface design to interact with legal semantic information
- Publishing/reusing legal-related content in Linked Data
- Legal semantic services and mobile applications
- Rules and Automated Reasoning in the Semantic Web
- Semantic Web technologies and Legal Scholarly Publishing
- Access to legal information and visualization
- Rights and licenses for data and semantics
- Law, Intellectual property and legal issues for data and schemas
- Licenses for Linked Open Data
- Information ethics and the SW
- Law and governance in deliberative democracy and democratic participation
- Normative Multi-agent Systems and the Semantic Web

Four papers have been accepted after the reviewing process, and they cover different topics from legal requirements for cloud-based service consumption to legal interpretations in Legal-RuleML, to legal support systems for the air transport passenger domain, to a logical model of guilt in crime. The invited speaker of the is Pompeu Casanovas (University of Barcelona, Spain) that will talk about Knowledge Acquisition, the Semantic Web and the pragmatic turn.

Given the growing interest of the two communities of Semantic Web and Law towards shared synergies, we hope that the workshop will be a selected venue to present the results of such joint effort also in the future.

November 24, 2014
Bologna and Sophia Antipolis

Silvio Peroni and Serena Villata

Mapping legal requirements to SLAs: an ontology based approach for cloud-based service consumption

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Abstract. *This work presents a new approach to ensure compliance to legal regulation in Cloud Computing, especially in Software-as-a-Service. Since high demanding business sectors, such as the health care sector, require high legal certainty, when contracting services offered by external providers. We provide a lightweight ontological representation of the German Federal Data Protection Act (BDSG) and a methodological approach how this work can be extended with additional laws. Furthermore, we integrate the generic ontology into the Linked Unified Service Description Language (Linked-USDL) as Compliance to External Services (Linked-USDL CES) module. This extension enables service customers and providers to negotiate services more fine grained related to legal obligations, which increases legal certainty and thus the acceptance of a cloud-based service consumption. We demonstrate the applicability of the proposed ontology with the concrete use case “physician’s letter” that is part of a running national project TRESOR, which aims at the development of a trusted cloud ecosystem.*

Keywords: Linked-USDL, Legal Regulation, Ontology, BDSG, Marketplace, Service Selection, Cloud Computing

1 Introduction

Through increasing awareness for the economic benefits it promises, Cloud Computing approaches gained momentum. Having neither geographical borders nor national limits, it is a global market where providers e.g. in India can have customers in Jamaica. On the one hand, this distribution and flexibility provide benefits for the customers. They are able to choose between offers from all over the world and select the most appropriate one. This process is mostly supported by marketplaces, which provide support for comparing different functional and non-functional aspects of products from different companies. This in turn, increases the competition in this market to the benefits of the customers. On the

other hand, it challenges businesses which are subject of legal restrictions and have to follow national regulatories for the used software and the utilized data. The aforementioned marketplaces are currently focusing on functional aspects and have a few non-functional details like pricing information. Due to the complexity of the laws and the expected legal consequences in case of disregard, the legal aspects are omitted so far.

In this paper, we want to attract attention to this issue by presenting concrete use cases from the health care sector along with the legal regulatories from the German privacy law. We advocate that legal aspects of Cloud Computing offers should be semantically described, enabling machine-supported comparability on marketplaces. By this means, the market is opened for businesses dealing with sensitive data. Concretely, we present an extension for Linked-USDL that is a remodeled version of the Unified Service Description Language (USDL). It is described with semantic technologies and published following the Linked Data principles. We exemplify the usage of the proposed extension by applying it to the German privacy law.

The remainder of this paper is structured as follows. In the following section, we elaborate the necessity for describing legal aspects of Cloud Computing offers (focusing on Software-as-a-Service), enabling businesses like the health care sector to benefit from the economic advantages. In Section 3 we present briefly the related work in this field. In Section 4 we describe the core contribution of this work, namely Linked USDL-CES and demonstrate in Section 5 the realization of a concrete use case. After discussing the main critical points of this work in Section 6, we conclude the paper with as summary and outlook in Section 7.

2 The Need for Describing Legal Aspects of SaaS Offers

Today, almost every organization makes use of IT components and software products to some extend. Thus, optimizations of capital as well as operational expenditure for IT solutions is concerning everyone. This explains the payed attention attracted by and the success of Cloud Computing approaches. By bundling resources and allowing shared usage, the different business models like Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-service (SaaS) optimize the exploitation of hardware as well as software components. This is expected to lead to promising significant economic benefits for the customers, which is mostly a convincing argument for the management levels of various organizations.

Being at the highest abstraction layer, SaaS solutions address end-users and have therefore the biggest audience. Whoever uses software is a potential customer for SaaS providers and can leverage its economic advantages. Currently, daily used enterprise software like office products and customer relationship management software as well as very specialized graphic tools for design experts are available “out-of-the-cloud”. This allows SaaS providers to offer their products globally and to acquire customers all over the world, where network connectivity is the only requirement.

For supporting the customers in selecting the best offer for their needs, different marketplaces for SaaS offers arise which provide functional as well as non-functional descriptions of existing offers and allow their comparison. However, for particular business sectors SaaS solutions are still not usable. As one concrete example, the health sector is subject of comprehensive legal restrictions and regulations. Although, a very simple SaaS solution for storing and editing doctors' records about patient treatment would reduce the costs of health care institutions significantly, this sector cannot make use of the economic benefits current Cloud Computing based solutions provide. In the current situation each institution has to have its own IT infrastructure and administration staff. Driven by this motivation, the currently running project Trusted Ecosystem for Standardized and Open cloud-based Resources (TRESOR) aims at opening the SaaS market for the health sector.

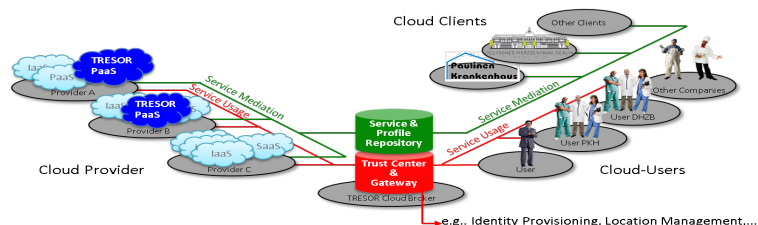


Fig. 1. Abstract illustration of the TRESOR project

The main objective of TRESOR is the development of a trusted cloud ecosystem that consists of an open platform for offering and consuming cloud services. A broker and marketplace component mediates and combines services, whereas a proxy enables the access to those cloud services by taking enterprise guidelines, regulations by law and security policies into consideration.

A central part of the TRESOR broker is the service description language, that enables describing various aspects of SaaS offers. The Linked-USDL extension that is presented in this paper is a possible add-on of this description language. With this extension, the health care institutions are able to control to which extend the offers are compliant with legal requirements, select the most appropriate one and establish negotiations. Due to the societal aspects of this particular sector, the achieved significant cost reduction is expected to have a remarkable impact on the societal expenses.

3 Related Work

Our goal is to support a fine grained description of compliance to legal regulations in a service description in order to increase legal certainty on both service provider and customer side. Our main task is to realize a Service Description Language (SDL) with a lightweight ontology, able to express the BDSG and

similar acts. Especially, legal obligations for service customers and providers including their relation to operation of a services and any processing of data are of interest. As next, we list and rate the related work in accordance with our tasks. In our rough structuring we differentiate between expressive and lightweight ontologies. Representatives of expressive ontologies are:

There are several ontologies in the field of legal reasoning and argumentation. Edwina Rissland et al. [25] discussed the characteristics of the legal domain and its main points of interest for the application of AI techniques in 1985. In [13, p. 2] seven challenges are listed that AI and the legal domain face. Since then, many representational languages and legal rules have been invented. However, none reached the full expressiveness and complexity of existing legal texts in a consistent manner [17]. Gordon et al. present a formal, mathematical model of argument evaluation which applies proof standard [18]. Prakken’s model [24] is suitable for modeling particular legal procedures, learning about actual legal procedures and to learn about the process of formalizing an actual legal dispute. Brüninghaus’ [10] methods automatically generate legal argumentation and predictions from case texts. The Ontology of Professional Judicial Knowledge (OPJK) [12] focuses on semantic search in the context of question and answer (Q&A) systems. A request, formulated in a natural language, leads to a response with a high level of concision. [12] but has no added value for our use-case. Gangemi et al. [15] introduce a design pattern for defining legal content ontologies. Whereas Despres et al. [14] focus on how to apply a linguistics-based tool “TERMINAE” to the legal domain and its alignment to core ontologies. However, all these approaches do not support us in our main objective to describe services and its properties related to legal regulations, such as required by the BDSG.

In the field of E-Contracting, the description of legal aspects and obligations mainly focus on general Terms and Conditions. Lamparter et al. [20] introduce a formal model in cooperating common contractual items and rights/obligations and applies the model in a scenario proving the creditworthiness of customers. The defined ontology allows the use of SWRL-based [19] rules in order to enable automated proofing of the results. However, this work seems to have several similarities and overlaps with our use-case, but does not focus on how to incorporate legal obligations.

The LKIF-core [9] bases on OWL. It covers a standard vocabulary of basic legal terms having the focus on scenarios where the exchange of knowledge between different knowledge-based systems is required. LKIF’s shortcomings are twofold. Firstly, both legal modules “legal-action” and “legal-role” offer terms which support the definition of rules in the context procedural terms and roles (compare action- role process). Furthermore, it is not easily possible to link to a specific law, such as the BDSG. This could lead to the need of extensive expansions. Secondly, the core ontology is defined in English. A mapping layer and legal dictionaries are required, which means that an additional fuzzy layer is present.

Knöpfler’s ontology already concentrates on the BDSG. However, his work is motivated by the Computational Law. His ontology [27] maps rules taken from the BDSG to programmable logic. Due to pragmatic reasons, Knöpfler chooses SWI-PROLOG [29] to proof the fundamental technical feasibility of his idea. He selects just a single section out of a total of 63 which already leads to an impressive amount of rules and objects. A meaningful and appropriate visualization is extremely difficult (comp. [27] p. 298.) to achieve. However, only few segments seem to be reusable for our goal to develop an ontology addressing compliance to legal regulation during a service description and requirement matching.

In contrast to aforementioned expressive legal ontologies, we identified several lightweight ontologies in the legal domain. This includes ontologies used for representation of legal documents, such as MetaLex [9], a structured and nearly complete representation, and the Akoma Ntosa XML standard presented by Barabucci et al. [8]. The European Union published the multi-language thesauri EuroVoc [4], which contains a subsection for legal terms. EuroVoc bases on a SKOS extension [3] and new definitions are taken from the dublin-core [1]. However, these technologies and achievements can only supplement our solution.

In the field of SDL, we identified the Linked-USDL [11], since it combines the Linked Data [22], [2] principles and the Web of Data by remodeling the existing USDL specification as RDF(S) vocabulary in order to enable a better support for machines when trading services on the Web of Data. Linked-USDL currently contains three modules: USDL-Core, USDL-Pricing and USDL-SLA [21]. The USDL comes with a legal module which is designed only to express copyright and license information. Thus, it is not usable to support legal compliance as defined in our scope.

Summing up, we have to propose our own lightweight ontology for describing services and their compliance to legal regulation for service discovery and selection scenarios. We choose Linked-USDL since its wide scope, its Linked-Data alignment and its focus on services descriptions seem to provide the most promising basement for adding appropriate ontologies able to describe acts and their obligations for service providers and consumers.

4 Ontological Description of Legal Compliance

The essential criteria for reliable decisions based upon service descriptions are twofold. The first criteria is a matter of knowledge and trust. The service to be described has to be known in-depth. By letting the service creator and service provider create the description, who are expected to possess the mentioned knowledge, this can be regarded merely as a question of trust. As such, it can be tackled e.g. by the introduction of a trusted 3rd party or some certification procedures. The second criteria is the quality of the service description language as well as its usability. On the one hand, the expressivity needs to allow the correct description of various facets. On the other hand, it needs to be easy to understand and to use.

Aiming at the description of legal aspects of SaaS services, we advocate making use of semantic technologies and following the Linked Data principles in reusing existing vocabularies and interlinking newly created ones with existing Web ontologies. To be more concrete, the Resource Description Framework (RDF), RDF Schema (RDFS) and the Web Ontology Language (OWL)) emerged from the Semantic Web vision and defined as standards by the World Wide Consortium (W3C) represent a profound basis for expressiveness in defining a language. Along with manifold tools for editing and reasoning, the usage of these standards is very promising. Additionally, the ever increasing number of online available vocabularies and ontologies for various domains, including the service description domain as well as the legal domain, encourage their reuse by pragmatically following the Linked Data principles. Reusing existing and broadly used ontologies, which can be seen as de-facto-standards, is expected to simplify the understanding of the new language constructs.

4.1 From the Law to the Ontology

The endeavor to develop an ontology, which provides language constructs to describe legal aspects of SaaS offers, requires the analysis of valid and relevant laws for the particular context. Due to the circumstance of the TRESOR project, we focused on the Germany Federal Data Protection Act (Bundesdatenschutzgesetz - BDSG)[16]. Because of the complexity of the domain as well as the hierarchical relations between national, European and global regulations, we decided to start with the concrete and develop the ontology in a bottom up approach. For that purpose, we analyzed the text of the Germany privacy law and modeled the domain ontology.

We extracted nine concrete characteristics applicable to SaaS services, which we call Compliance Criteria. For each we defined a set of possible Criteria Values. Figure 2-Ⓐ illustrates this in a simple notation.

The extraction process we applied consist of the following steps:

- 1.0 Rough structuring of the BDSG [16] and scope reduction.
- 2.0 Define and structure the requirements.
 - 2.1 Compliance BDSG examples
 - 2.2 Compliance BDSG and USDL-CES
- 3.0 Defining an ontology - The USDL-CES

Through the first step (rough structuring), we identified the following six sections. (1) *General and common provisions*, (2) *Data processing by public bodies*, which includes subsections, such as *Legal basis for data processing*, *Rights of the data subject* and *Federal Commissioner for Data Protection and Freedom of Information*. (3) section *Data processing by private bodies and commercial enterprises under public law* contains of three subsections. The subsection *Legal basis for data processing* is followed by *Rights of the data subject* and *Supervisory authority*. In the end the structuring conclude with (4) *Special-*, (5) *Final-* and (6) *Transitional-provisions*. Based on this structure we can now concentrate on further questions, such as:

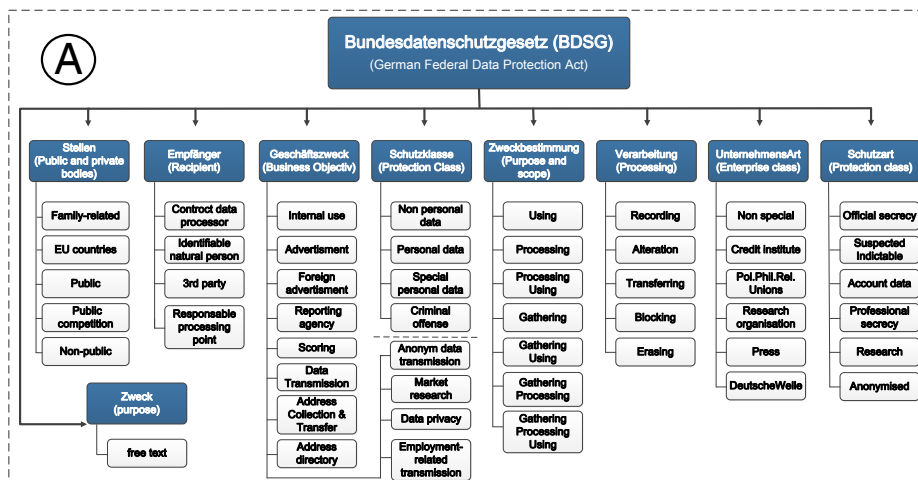


Fig. 2. German Federal Data Protection Act (BDSG) Taxonomy

Q: Which sections contain relevant information for legal compliance? Which we answer by: all sections containing obligations.

Q: Which sections contain rights for 3rd parties? For the opposite case this can be seen as obligations for service-customers and service-providers which includes e.g. rights, such as “provision of information and granting permission to consult records to the persons concerned”.

In order to reduce the scope, answering the opposite questions help to exclude non-relevant legal text parts.

Recipient (Empfänger)		
Name	Value	Description
Contract data processor	1	Bodies collecting, processing or using personal data on behalf of others, in accordance with §11 and §46 (3)
Identifiable natural person (“subject”).	2	A natural person who can be identified and to whom the data belongs, in accordance with §3 (1)
3rd Party	3	Each recipient of data or any person or body other than the controller, in accordance with §3 (8), §46 (3)
Responsible Processing Point (Controller)	4	Any person or body which collects, processes or uses personal data on his, her or its own behalf, or which commissions others to do the same. In accord. with §3 (7)

Table 1. Characteristics of Compliance Criteria “Recipient (Empfänger)”

In our case, based on the recently introduced BDSG sections, our result can be summed up as: the core of the relevant legal sections are part of Section 2 and 3. Here we find concrete rules and guidelines for handling data within different scopes and purposes, distinguished by public and private institutions.

This information is important, since service providers do not know service-customers' obligations. Furthermore, Section 4 "Lawfulness of data collection, processing and use" is important, since (1) stated: "The collection, processing and use of personal data shall be lawful only if permitted or ordered by this Act or other law, or if the data subject has provided consent". In summary, it can be ascertained that after rough structuring and scope reduction some Sections, such as Section 1, Section 2 including Subsection 3, Section 5 and 6 (Final- and Transitional-provisions) can be skipped.

Gathering criteria is time consuming (and can be improved or automated for sure), since it requires to understand the legal text in details and derive necessary conclusions. The complete result of our work is spread over approximated 20 printed pages. Therefore, we are going to list just some for Section 5 relevant use-case criteria in Table 1 and 2. However, additional information is available online [7]:

Public and Private Bodies (Stelle)		
Name	Value	Description
Family-related	1	Personal or family related in accordance with §1 (2) No.3
EU countries	2	EU/EWR country without germen establishment in accordance with §1 (5)
Public	3	Processing Points in accordance with §2(1)-(3)
Public competition	4	Public undertaking, participation in the economic contest in accordance with §27 (1) No. 2 (commercial enterprises which are, though in public ownership, exposed to competition)
Non-public	5	Non-public Processing Point in accordance with §2(4)

Table 2. Characteristic of Compliance Criteria "Public and Private Bodies (Stelle)"

4.2 Abstracting from the Law Ontology

Following the design of Linked-USDL, we introduce *USDL-CES* module in order to address common Compliance for External Services (CES). The goal of CES is to create a structure which can express on the one hand afore mentioned BDSG taxonomy and on the other laws, structured in a similar way. Figure 3-Ⓔ depicts the ontology. The three levels between Figure 2-Ⓐ and Figure 3-Ⓔ are congruent and show how to instantiate the BDSG-Taxonomy. "BDSG" maps to "Statute or Act", "Recipients" maps to "Compliance criteria" and "3rd Party" maps to "Criteria Value". In case of replacing the taxonomy by an

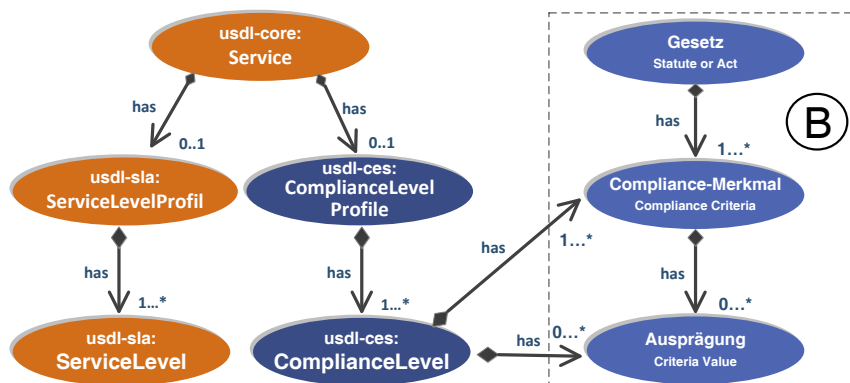


Fig. 3. Combining the generic BDSG taxonomy with the Linked-USDL ontology

appropriate taxonomy expressing other acts, different namespaces should be introduced and applied.

4.3 LinkedUSDLCES (Integration into LinkedUSDL)

In order to use this ontology for service description, we combine the USDLCES with Linked-USDL, as depicted in Figure 3.

5 Realizing a Use-Case with Linked USDLCES

We apply our approach to a sample use-case motivated by the TRESOR project. In this example a hospital, which is a *Public Enterprise* and acts as a *Public Body* wants to use a *Physician's Letter*-service provided by an external service provider (*Recipient: 3rd party*). The hospital's requirements on legal regulation related to this use-case are listed in Table ???. Since the *Business Objective* is set to *Internal Usage*, the hospital may - under specific requirements - use (compare BDSG Section 14) the *Special Personal Data* for other internal purposes. *Special Personal Data* refers to especially *Sensitive Personal Information* (compare BDSG Section 3, Paragraph 9) to be processed, which includes medical data of patients. For instance, the service provider retrieves the knowledge by both statements, that the usage of *Special Personal Data* under the terms an definition of BDSG Section 14, Paragraph 5 is permitted even if the purpose is not listed. Since *Physician's Letter* is stated as *purpose* the service provider can derive that it is prohibited to transfer the data to 3rd parties, such as laboratories. This example shows how restrictive the criteria can be handled and enforced with our approach. In addition, we achieve a high level of compliance to legal regulation which means a higher level of legal certainty for all parties, service customer (SC) and service provider (SP).

Compliance Criteria (Name)		Criteria Value (Ausprägung)	
English	German	English	German
Pub./Priv. Bodies	Stelle	Public	ÖffWettbewerber
Recipient	Empfänger	3rd Party	Dritter
Business Objectiv	Geschäftszweck	Internal usage	Eigennutzen
Protection Class	Schutzklasse	Special Personal Data	BesPersonenDaten
Purpose and Scope	Zweckbestimmung	Using	Nutzen
Processing	Verarbeitung	n/a	<keine Angabe >
Purpose	Zweck	Physician's Letter	"Arztbrief"
Enterprise Class	UnternehmenArt	n/a	<keine Angabe >
Protection Class	Schutzart	n/a	<keine Angabe >

Table 3. Description of BDSG legal compliance criteria and values - Physician's Letter

6 Discussion

Due to the challenging objective of this work, it has inherently some critical points, we want to discuss briefly in this section. The first one is the semantic complexity and expressiveness of the proposed ontology. However, the creation of an ontological representation of laws is a difficult task. Even if the ontology engineer focuses only on a small part. On the one hand, understanding the meaning of legal text in-depth without being an expert for the concrete legal text at hand is very challenging. In order to understand all aspects and to comprehend the interrelation with other laws, it is also necessary to know how judges interpreted the text and how they made their decisions in concrete examples. On the other hand, creating a comprehensive ontology, that represents such a complex knowledge exhaustively seems to be unfeasible. This is due to the fact, that reliable decisions in this context can only be made within margin of discretion by humans, respective judges.

Therefore, an ontology for such a domain is not expected to represent the knowledge enabling automatic decision making, but the basic terms in order to allow communicating the legal aspects between providers and customers. In this concrete work, we aim at providing a basic set of terms, representing an extraction from the German law, namely BDSG, and allowing SaaS providers to communicate legal compliance. We are convinced that such a description is essential for the success of SaaS for sensitive business sectors and want to attract attention to this issue and make a first proposal.

A second critical aspect is its focus on the German law. However, as one of the most comprehensive privacy data protection laws available, we think that it provides a good starting point and represents the basis for fruitful discussions for the next steps, towards an international standard.

The last critical aspect, we want to mention is the following. For a really legally valid description language, an internationally accepted standard has to be created with the authorities in this area. Until then, we think it is of high

value to work on basics towards this challenging goal and expect some lightweight ontologies become de-facto-standards. These in turn, can simplify the definition of a real standard.

7 Summary and Outlook

In order to support a better legal compliance when negotiating contracts between SaaS consumers and providers, we propose a generic methodology for deriving a taxonomy for specific laws/acts, such as the German Federal Data Protection Act (BDSG). Based on the taxonomy we described how to instantiate the taxonomy in our generic Linked-USDL CES module, which we propose as new extension for Linked-USDL. As proof of concept, we applied our approach in a sample use-case named *Physician's Letter* in the context of the Cloud Ecosystem TRESOR [6]. Since we finished our research before Pedrinaci et al. presented a Linked-USDL vocabulary [23], we have to check whether an adaptation is required. A next step could be to create taxonomies for other German or European acts.

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Legal Interpretations in LegalRuleML

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Abstract. Legislative documents are by their own nature subject to interpretation, and interpretations of one document can diverge. In this paper we discuss the mechanism proposed by LegalRuleML to capture alternative interpretations or renderings of a legal source. LegalRuleML allows for mutually incompatible renderings (or interpretations) of a legal source to coexist in the same LegalRuleML document, and provides facilities to identify the interpretations and to select them. The mechanism is illustrated with an example from Italian Jurisprudence.

1 Introduction

A common trait of legal reasoning and practice is that it is often possible to have multiple interpretations of one and the same textual provision, where there is no true interpretation. Such alternative interpretations might be mutually incompatible. This is often the case in legal disputes where the parties involved put forward their interpretations and where the judge has to select one of them or propose another interpretation.

In this paper we report on the efforts of the OASIS LegalRuleML Technical Committee to capture the phenomenon of multiple interpretations in the LegalRuleML standard [21, 1]. The key intuition is that an interpretation is modelled by a set of LegalRuleML statements (e.g., rules) and a norm or textual provision can be modelled by several alternatives where each alternative has enough metadata to determine its context and provenance. The paper outlines LegalRuleML components and illustrates them with examples, e.g. a real life case from Italian Jurisprudence where the topic of discussion of the case was on different interpretations of a textual provision.

The work on interpretation in LegalRuleML is set in the more general context of interpretation in Linguistics in general and Forensic Linguistics in particular. In Linguistics, issues about interpretation have long been of central concern (from [9] to [18]), where the need for interpretation arises given that the meanings (broadly construed) of “linguistic signs”, e.g. words, sentences, and discourses, can vary depending on participants, context, purpose, and other parameters. Interpretation is, then, giving the meaning of the linguistic signs for a given set of parameters. While the relationship between signs

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and meaning is arbitrary in principle [9], most contemporary linguistic research has attempted to identify principles and constraints around interpretation in order to account for a range of consistent, widespread, and observable linguistic patterns. After all, what is truly arbitrary can only be catalogued and not made the object of deeper scientific scrutiny. Research efforts have focussed on syntactic ambiguity, reference, vagueness, semantic scope, and other phenomena. It is worth noting that high performance, statistically based, contemporary parsers (e.g. Stanford's Dependency Parser [8]) or a parser with associated semantic representation, (e.g. C&C/Boxer [7]) do not exclude alternative parses or semantic representations.

In Forensic Linguistics, such considerations are applied to legal texts [22, 24, 4], though with legal specific considerations. Laws prescribe behaviour, so knowing the interpretation of a law in a context matters in terms of guiding conduct. Laws can be challenged, thus opening presentation of alternative interpretations. Laws are composed for social consumption, leading to issues bearing on who composed them, for what purpose, to apply to what other parties, and so on. In addition, laws and circumstances change over time, requiring active maintenance of interpretation. Finally, the practice of law over time has developed its own catalogue of *hermeneutical principles*, a range of techniques to interpret the law, such as catalogued and discussed in [23].

LegalRuleML endeavours not to *account* for how different interpretations arise, but to provide a mechanism to record and represent them. The main novelty of this paper is the presentation of a formal representation of legal interpretation. In Section 2 some of the relevant background literature is reviewed. The running example is presented in Section 3. The case study is formalised in LegalRuleML in Section 4. The paper concludes with Section 5.

2 Related Work and OASIS LegalRuleML

Norms, guidelines and rules are found in a variety of legal texts. As text, the semantic content (including meta-data) is difficult to exchange between parties or to otherwise process or reuse by automated applications. Yet it is essential to eGovernment and eCommerce services that such content has a machine-readable form such that applications can be deployed. The LegalRuleML TC, which was set up inside of OASIS (www.oasis-open.org), aims to produce a rule interchange language for the legal domain. Using the representation, developers can provide applications to process legal contents for data interchange, comparison, evaluation, and reasoning.

Over the last twenty years, the Artificial Intelligence (AI) and Law communities have converged on modelling legal norms and guidelines using logic and other formal techniques. With existing methods, a Legal Knowledge Engineer analyses the text, scopes the analysis, extracts the norms and guidelines, applies models and a theory within a logical framework, and finally represents the norms using a particular formalism. In the last decade, several Legal XML standards have been proposed to describe legal texts [19] with XML-based rules (RuleML, SWRL, RIF, LKIF, etc.) [13, 12]. At the same time, the Semantic Web, in particular Legal Ontology research combined with semantic norm extraction based on Natural Language Processing (NLP) [11], has given

a strong impetus to the modelling of legal concepts [5, 2, 6]. We discuss some of these below.

Legal Knowledge Interchange Format (LKIF) is a specification that includes a legal core ontology and a legal rule language that closely represents legal knowledge and reasoning [10, 17, 12]. LKIF does not provide mechanisms to handle concurrent interpretations of a legal source; more specifically, while it might be possible to represent the content of the individual (alternative) interpretations, it is not possible to specify that these representations are mutually exclusive.

RuleML is a family of languages, whose modular system of schemas for XML permits high-precision web rule interchange (http://wiki.ruleml.org/index.php/RuleML_Home). LegalRuleML is part of this family of languages. RuleML distinguishes deliberation from reaction rules. Deliberation rules include modal and derivation rules, e.g. facts, queries, and Horn rules. Reaction rules include Complex Event Processing, Knowledge Representation, Event-Condition-Action, and Production. RuleML rules can combine derivation and reaction rules, allowing uniform XML serialization across rules.

RIF (http://www.w3.org/2005/rules/wiki/RIF_Working_Group) is a W3C recommendation for a standard Web Rule Interchange Format to exchange rule sets among different rule systems. It makes use of Internationalized Resource Identifiers and supports XML Schema data types. The RIF architecture is conceived as a family of languages. A RIF dialect is a rule-based language with an XML syntax and a well-defined semantics. RIF does not provide direct support for adequate representation of legal rules and legal reasoning since they do not support e.g. logic-based negation, non-monotonic reasoning, events and temporal metadata, among other relevant features.

The Semantics of Business Vocabulary and Business Rules (SBVR) [20] provides a controlled natural language [25] of fixed and finite vocabulary and syntactic form for the expression of the terminology, facts, and rules for business documents across a range of business activities and organisations. SBVR has an associated XML Metadata Interchange (XMI), which supports the interchange of documents across businesses. SBVR and LegalRuleML are closely related in that both provide XML encodings of the semantics of terminology, facts, and rules. SBVR bears on business rules, which may or may not have legal standing; LegalRuleML represents statements of legal standing. LegalRuleML's temporal notions of *enforceability*, *efficacy*, and *applicability* are not provided in SBVR. LegalRuleML enables the expression of *defeasibility*, a rich range of *deontic concepts*, and associated concepts of *penalty* and *reparation*.

Given this context, the LegalRuleML Technical Committee has focused on three specific needs [21, 1]:

1. To close the gap between natural language text description and semantic norm modelling.
2. To provide an expressive XML standard for modelling normative rules that satisfies legal domain requirements [15, 16].
3. To extend the Linked Open Data [3] approach to modelling from raw data (acts, contracts, court files, judgements, etc.) to legal concepts and rules along with their functionality and usage.

The main novelty of LegalRuleML and the contribution of this paper is that it provides a formal representation for alternative interpretations of a legal source (textual provision), which is not found in other formal modelling languages.

3 Case Study

In this section we propose a real life case (taken from the Italian legal system and jurisprudence, originally discussed in [14]) depending on multiple (alternative) interpretation of a norm, and we show possible formalisations of the case and the interpretations. In the next section we are going to use the formal representations developed in this section to illustrate the LegalRuleML mechanisms to cope with the phenomenon of multiple interpretations. The case is based on a dispute of Art. 1, Comma 2, Law 379/1990. The article recites

The benefit referred to in comma 1 shall be paid in an amount equal 80 per cent of five-twelfths of the income earned and reported for tax purposes by the freelancer in the second year preceding the year of application.¹

The case 18/96, Bologna Tribunal, Imola Section, concerns the interpretation of the conjunction in *the income earned and reported for tax purposes*. . . .

A fundamental and unalienable principle of legal language is its close connection with natural language; in particular, the interpretation of a textual provision should be the ordinary meaning conveyed by the text of the provision taking into account its context in the act in which it appears and the purpose or object underlying the act. For example, in the Italian legal systems this connection is prescribed by Article 12 of the Preleggi, Italian Civil Code, stating

In applying a statute, the interpreter should not attribute to it a meaning different from that made evident by the proper meaning of the words and by their connection, as well as by the intention of the law maker.²

Accordingly, the literal interpretation of the norm is given by the rule

$$earned(x, y-2) \wedge reported(x, y-2) \Rightarrow \left[\text{OBL}_{\text{bearer}=\text{employer}}^{\text{auxiliary}=\text{freelancer}} \right] paybenefit(f(x), y) \quad (1)$$

The arguments of the predicates *earned* and *reported* are the income x earned/reported in the year in the second argument ($y - 2$). Similarly for *paybenefit* where the function f encodes the computation of the value of the benefit based on the value of the income x . However, according to the Italian taxation legislation in force at the time of the dispute the income received in one year is reported for tax purpose the year after the year it has

¹ L'indennità di cui al comma 1 viene corrisposta in misura pari all'80 per cento di cinque dodicesimi del reddito percepito e denunciato ai fini fiscali dalla libera professionista nel secondo anno precedente a quello della domanda.

² Nell'applicare la legge non si può ad essa attribuire altro senso che quello fatto palese dal significato proprio delle parole secondo la connessione di esse, e dalla intenzione del legislatore.

been earned. Thus, for example, the income earned in 1995 is reported in 1996. This principle can be formulated as follows:

$$earned(x, y) \rightarrow reported(x, y + 1) \quad (2)$$

$$reported(x, y) \rightarrow earned(x, y - 1) \quad (3)$$

Consider now the *Income* constant obtained by applying the Russell's definite description operator (ι) on the conjunction in the left-hand side of (1).

$$Income = \iota x(earned(x, y) \wedge reported(x, y)) \quad (4)$$

The conclusion is that the constant *Income* is not denoting, i.e., the interpretation of *Income* is \emptyset , thus there is no income "entity" that is earned and reported in one and the same year. Hence, the left hand side of the rule in (1) never holds, and the rule never fires, against the intentions of the legislator.

Based on the textual provision two possible interpretations are possible: in the first interpretation the temporal expression "in the second year preceding the year of application" refers to the income earned in the second year preceding the application, while in the second interpretation it refers to the income reported for tax purposed in the second year preceding the application. For example, for an application in year 1998, the first interpretation bases the computation on the income earned in 1996 (and reported in 1997), while for the second interpretation, the value of the benefit is computed starting from the income reported in 1996 (and earned in 1995). Accordingly, the first interpretation, the interpretation proposed by the freelancer in the case, can be formalised by the rule

$$earned(x, y - 2) \Rightarrow \left[\text{OBL}_{\text{bearer}=\text{employer}}^{\text{auxiliary}=\text{freelancer}} \right] \text{paybenefit}(f(x), y) \quad (5)$$

Similarly the second interpretation, the interpretation proposed by the employer, can be represented by the rule³

$$reported(x, y - 2) \Rightarrow \left[\text{OBL}_{\text{bearer}=\text{employer}}^{\text{auxiliary}=\text{freelancer}} \right] \text{paybenefit}(f(x), y) \quad (6)$$

The task of the Judge was to decide which of the two interpretations has to be used for the application of the norm. In the case the Judge argue in favour of the interpretation advanced by the freelancer.

4 LegalRuleML Representation of the Case Study

In the previous section we presented three possible interpretations of the norm, the literal interpretation, the interpretation of the freelancer and the interpretation of the

³ Alternatively, we could use $earned(x, y - 3) \Rightarrow \left[\text{OBL}_{\text{bearer}=\text{employer}}^{\text{auxiliary}=\text{freelancer}} \right] \text{paybenefit}(f(x))$, while, from a formal point of view, it is semantically equivalent to (6) it is less close in meaning to the textual provision than its counterpart: the temporal reference in the argument would "third year preceding the year of the application".

employer. Here we are going to present the LegalRuleML fragments required to encode the formalisations corresponding to the three interpretations. The formalisations of these three statements can be represented as prescriptive rules which are encoded by `<lrml:PrescriptiveStatement>` blocks in LegalRuleML, each containing one `<ruleml:Rule>` Template. The following fragment corresponds to the literal interpretation, i.e., (I)

```

<lrml:PrescriptiveStatement key="literal">
  <ruleml:Rule closure="universal" key=":literal-template">
    <ruleml:if>
      <ruleml:And>
        <ruleml:Atom key=":atom-earned">
          <ruleml:Rel iri="#earned"/>
          <ruleml:Var>income</ruleml:Var>
          <ruleml:Expr>
            <ruleml:Fun iri="#subtract"/>
            <ruleml:Var>year</ruleml:Var>
            <ruleml>Data xsi:type="xs:integer">2</ruleml>Data>
          </ruleml:Expr>
        </ruleml:Atom>
        <ruleml:Atom key=":atom-reported">
          <ruleml:Rel iri="#reported"/>
          <ruleml:Var>income</ruleml:Var>
          <ruleml:Expr>
            <ruleml:Fun iri="#subtract"/>
            <ruleml:Var>year</ruleml:Var>
            <ruleml>Data xsi:type="xs:integer">2</ruleml>Data>
          </ruleml:Expr>
        </ruleml:Atom>
      </ruleml:And>
    </ruleml:if>
    <ruleml:then>
      <lrml:Obligation key="obl-paybenefit">
        <ruleml:slot>
          <lrml:Bearer/>
          <ruleml:Var>Employer</ruleml:Var>
        </ruleml:slot>
        <ruleml:slot>
          <lrml:AuxiliaryParty/>
          <ruleml:Var>Freelancer</ruleml:Var>
        </ruleml:slot>
        <ruleml:Atom>
          <ruleml:Rel iri="#paybenefit"/>
          <ruleml:Expr>
            <ruleml:Fun iri="#80_percent_of_five-twelfths_of"/>
            <ruleml:Var>income</ruleml:Var>
          </ruleml:Expr>
          <ruleml:Var>year</ruleml:Var>
        </ruleml:Atom>
      </lrml:Obligation>
    </ruleml:then>
  </ruleml:Rule>
</lrml:PrescriptiveStatement>

```

Since LegalRuleML is built on top of RuleML we can reuse all RuleML facilities, in particular we can use `<ruleml:Expr>` and `<ruleml:Fun>` to encode the computation of the benefit to be paid to the freelancer.

The next snippet captures the interpretation of the freelancer, i.e., (5).

```
<lrml:PrescriptiveStatement key="freelancer">
  <ruleml:Rule closure="universal" key=":freelancer-template">
    <ruleml:if>
      <ruleml:Atom keyref=":atom-earned"/>
    </ruleml:if>
    <ruleml:then>
      <lrml:Obligation keyref="#obl-paybenefit"/>
    </ruleml:then>
  </ruleml:Rule>
</lrml:PrescriptiveStatement>
```

Notice that inside this statement we can use keyrefs to refer to the elements already defined in the block corresponding to the literal interpretation. Similar considerations apply to the block modelling (6), the employer's interpretation, below.

```
<lrml:PrescriptiveStatement key="employer">
  <ruleml:Rule closure="universal" key=":employer-template">
    <ruleml:if>
      <ruleml:Atom keyref=":atom-reported"/>
    </ruleml:if>
    <ruleml:then>
      <lrml:Obligation keyref="#obl-paybenefit"/>
    </ruleml:then>
  </ruleml:Rule>
</lrml:PrescriptiveStatement>
```

The following LegalRuleML Constitutive Statement represents the principle expressed in (2), that earned income will be reported in the following year. Because a Constitutive Statement defines concepts and does not prescribe behaviours, the consequent of its `<ruleml:Rule>` Template does not contain deontic operators.

```
<lrml:ConstitutiveStatement key="tax1">
  <ruleml:Rule closure="universal">
    <ruleml:if>
      <ruleml:Atom>
        <ruleml:Rel iri="#earned"/>
        <ruleml:Var>income</ruleml:Var>
        <ruleml:Var>year</ruleml:Var>
      </ruleml:Atom>
    </ruleml:if>
    <ruleml:then>
      <ruleml:Atom>
        <ruleml:Rel iri="#reported"/>
        <ruleml:Var>income</ruleml:Var>
        <ruleml:Expr key=":year+1">
          <ruleml:Fun iri="#add"/>
          <ruleml:Var>year</ruleml:Var>
          <ruleml>Data xsi:type="xs:integer">1</ruleml>Data>
        </ruleml:Expr>
      </ruleml:Atom>
    </ruleml:then>
  </ruleml:Rule>
</lrml:ConstitutiveStatement>
```

```

    </ruleml:Atom>
  </ruleml:then>
</ruleml:Rule>
</lrml:ConstitutiveStatement>

```

Similarly, the following fragment represents the principle that reported income was earned in the previous year, as expressed in (3).

```

<lrml:ConstitutiveStatement key="tax2">
  <ruleml:Rule closure="universal">
    <ruleml:if>
      <ruleml:Atom>
        <ruleml:Rel iri="#reported"/>
        <ruleml:Var>income</ruleml:Var>
        <ruleml:Var>year</ruleml:Var>
      </ruleml:Atom>
    </ruleml:if>
    <ruleml:then>
      <ruleml:Atom>
        <ruleml:Rel iri="#earned"/>
        <ruleml:Var>income</ruleml:Var>
        <ruleml:Expr key=":year-1">
          <ruleml:Fun iri="#subtract"/>
          <ruleml:Var>year</ruleml:Var>
          <ruleml>Data xsi:type="xs:integer">1</ruleml:Data>
        </ruleml:Expr>
      </ruleml:Atom>
    </ruleml:then>
  </ruleml:Rule>
</lrml:ConstitutiveStatement>

```

After the renderings of the alternative interpretations and the relationships between the predicates *earned* and *reported* given by the three constitutive rules, we have to specify that they are mutually exclusive formalisation of the same norm. This can be achieved by following Alternatives block that represents a mutually-exclusive collection of renderings of the Legal Norms from the Legal Source #1s1. The <lrml:LegalSource> with key #1s1, not shown in the text, contains the references to the actual text of the norm.

```

<lrml:Alternatives key="maternity-altS">
  <lrml:Comment> These alternatives are mutually
    incompatible formalizations of the same legal source: keyref="#1s1".
  </lrml:Comment>
  <lrml:hasAlternative keyref="#literal" />
  <lrml:hasAlternative keyref="#freelancer" />
  <lrml:hasAlternative keyref="#employer" />
</lrml:Alternatives>

```

A <lrml:Context> block is used to render a collection of Associations, e.g. the Association of a Legal Source with a rendering of it as a LegalRuleML Statement, or to constrain other Contexts with respect to Alternatives. The following Context establishes a constraint that at most one of the Alternatives from the collection #maternity-altS may be selected by each Context:


```
<lrm1:Context key="maternity-alts-ctxt">
  <lrm1:appliesAssociations keyref="#asn-alts"/>
  <lrm1:appliesAlternatives keyref="#maternity-alts"/>
</lrm1:Context>
```

The Context metadata, e.g. authorship, source, authority, temporal and jurisdictional properties, are specified in an external (to the Context) Association block with identifier `asn-alts`, not shown in the paper, which is referenced using `keyref`. Similarly other Context blocks (also not shown in the paper) are given with the metadata about the authors of the various Statements. This permits to establish the provenance of the interpretations.

In the following fragment, a particular Alternative – that proposed by the freelancer – is selected, leading to the generation of the corresponding `<ruleml:Rule>` from the rule Template `:freelancer-template`.

```
<lrm1:Context key="adjudication">
  <lrm1:appliesAssociation keyref="#asn-adjudication"/>
  <lrm1:inScope keyref="#freelancer"/>
</lrm1:Context>
```

Unlike the first Context block, this one contains an `<lrm1:inScope>` element. Such Contexts render interpretations that select one or more Statements as their scope of interpretation. When a Context is processed for presentation or inference, Legal Rules⁴ are generated from the `<ruleml:Rule>` Templates of in-scope Statements, annotated and optionally modified semantically by the Associations of the Context.

In this example the external Association `asn-adjudication` links the metadata for the adjudication of the case with a particular rendering of the norm, the rendering `freelancer`, corresponding to the interpretation proposed by the freelancer and confirmed by the judge⁵.

5 Conclusions and Future Work

In this paper, we presented the mechanisms for the representation of (mutually incompatible) alternative interpretations of legal sources (textual provisions) in a LegalRuleML document. Specifically, we introduced the `<lrm1:Alternatives>` element that is to be used to specify alternative formal renderings of a legal source, where the alternatives in a block are mutually exclusive. The key idea is that each rendering corresponds to an interpretation of the legal source. Using `<lrm1:Alternatives>` along with `<lrm1:Context>` blocks, we can specify the different formal renderings of a legal source and their metadata that associates them with other elements in a LegalRuleML document, e.g. the interpreter of the legal sources, the time of such interpretations, and the context where

⁴ In this paper, we focus on Prescriptive and Constitutive Statements, which always lead to generated Legal Rules. However, in the general case, e.g. `<lrm1:FactualStatement>`, something other than a Legal Rule may be generated when a Statement is in scope.

⁵ The full example is available from https://tools.oasis-open.org/version-control/browse/wsvn/legalruleml/trunk/examples/approved/maternity_alternatives_compact.lrm1

such interpretations apply. Furthermore, we presented a real life case that illustrates how to use `<lrml:Alternatives>` to model the different interpretations of an ambiguous legal source such as arise in a legal dispute. An important advantage of the use of `<lrml:Alternatives>` is that it reduces redundancies in encoding the formalisation of a legal document. Different interpretations of a legal document can occur for many reasons (e.g., different readings of one norm by the parties involved in a legal dispute, different granularity of representation required by different applications, different interpretations with respect different (sub-)jurisdictions, the change of interpretation of terms over time, . . .). The mechanism we have proposed does not force the author of a LegalRuleML document to duplicate and modify the document just to accommodate every different interpretation of a legal source. All the author has to do is to create an `<lrml:Alternatives>` block in a single LegalRuleML document, add the various alternatives in the block, and refer to it from `<lrml:Context>` blocks that associate metadata with sets of statements. Then by filtering with respect to the metadata associated with an alternative, one can generate the manifestation of the document corresponding to alternative interpretations selected by the filtering conditions, employing the `<lrml:Alternatives>` expression to ensure that mutually incompatible alternatives are not simultaneously asserted in the same context.

The LegalRuleML syntax for the metadata collections, e.g. Alternatives, Jurisdictions, LegalSources, was designed to facilitate the exposure of these relationships as Linked Open Data (LOD). The RDF Collection structure is particularly appropriate for this, because it can be closed, indicating that the collection contains only the entities explicitly asserted to belong to it. An XSLT transformation will be developed to convert the LegalRuleML XML into RDF, while an RDFS metamodel will capture additional constraints. We envision that the major benefits of the RDF representation of LegalRuleML are the possibility to integrate the legal knowledge with information stored in other Open Data repositories and triple stores, and the ability to use tools such as SPARQL reasoners for preprocessing LegalRuleML documents before passing data to specialised legal reasoners.

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Ontology-Driven Legal Support-System in the Air Transport Passenger Domain

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Abstract. This paper aims to present a preliminary version of a support-system in the air transport passenger domain. This system relies upon an underlying ontological structure representing a normative framework to facilitate the provision of contextualized relevant legal information. This information includes the passenger's rights and it enhances self-litigation and the decision-making process of passengers. Our contribution is based in the attempt of rendering a user-centric-legal information grounded on case-scenarios of the most pronounced incidents related to the consumer complaints in the EU. A number of advantages with respect to the current state-of-the-art services are discussed and a case study illustrates a possible technological application.

Keywords. ontology, air transport passenger rights, incidents, complaint, online dispute resolution

1 Introduction

Air transport passenger's realm, notwithstanding being one of the most regulated¹ consumer-facing industry, unleashes a high number of disputes, due to its non-conforming performance (featured by flight disruptions, such as overbooking, long delays, cancellations, missing baggages or poor service quality) and also to extraordinary circumstances² out of the airline's actual control, as depicted in Figure 1 and 2. We are cognizant of the main reasons³ underlying this failure, which stems from: i)

¹ Complex patchwork of regulation composed principally by Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, European Communications, etc.

² Events that are beyond the airline's control, such as political instability, meteorological conditions incompatible with the operation of the flight, security risks, unexpected flight safety shortcomings, strikes affecting the operation of an operating air carrier, natural disasters; Draft list of extraordinary circumstances following the National Enforcement Bodies (NEB) meeting held on 12 April 2013, available in <http://ec.europa.eu/transport/themes/passengers/air/doc/neb-extraordinary-circumstances-list.pdf>.

³ Air Passenger Rights Revision - summary European Commission - MEMO/13/203, available in http://europa.eu/rapid/press-release_MEMO-13-203_en.htm.

existent legal grey areas; ii) unawareness of passengers' rights and iii) complex complaint handling procedures.

The objective is to render the necessary contextualized customized air-travel legal information, "at the point" of dispute resolution, for an early case assessment and to promote self-litigation in out-of-court disputes between passengers and operators. An account for the grounds for complaints is presented in [1].

Our approach, in particular, is enhanced with Semantic Web technologies that permits standards-based legal knowledge representation, which enables the possibility of legal information reuse over the web and also possibly through other stakeholders, such as National Enforcement Bodies, ECC-Net, European institutions, airlines and business from the travel sector. This assertion substantiates the research question of this paper: how to represent in an intelligent support-system the legal relevant information in the Air Transport Passenger's domain(ATP), the incidents that cause the main disputes and the workflow to follow in case of a complaint, permitting both consumers and airlines to understand their legal position and make an informed decision in run-time assets.

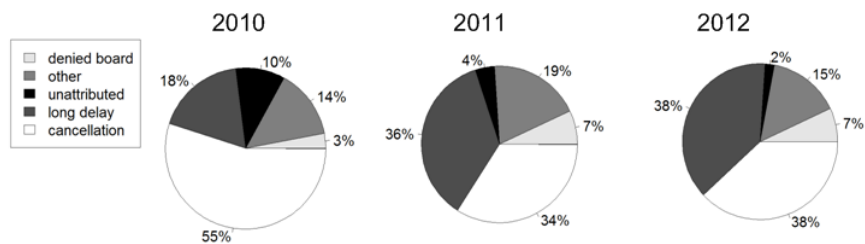


Fig. 1. Evolution of distribution between grounds for lodging complaints in 2010-2012⁴

The rest of this paper is structured in the following way. The next section will reflect the existing related services in the ATP domain. In Section 3 we describe the structure of the networked ontologies, its formalization and a case-study furnishes an illustration of a possible technical application. In Section 4 we conclude, outlining the future work.

⁴ SWD (2014) Commission Staff Working Document, Document on Complaint handling and enforcement by Member States of the Air Passenger Rights Regulations, p. 24

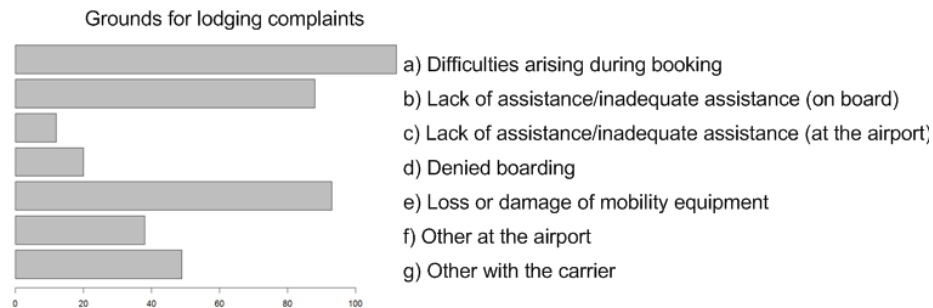


Fig. 2. Grounds for lodging complaints in 2012⁵

2 Background

Several initiatives have been approached supporting Online Dispute Resolution [1]-[6], but also concretely in the ATP domain, such as Flightright⁶ and Getairhelp⁷ which establish a free compensation calculator that a passenger might be entitled to in case of flight disruption. Their procedure is defined as follows: if there is a positive estimation from the compensation calculator they will manually evaluate the chances of a successful claim collection. If the prospects are promising, thereby they bring the claim forward against the airline, tracking its status. It follows that when every airline does not respond to the demand for payment or declines to pay, these companies recommend each user to engage the commissioned lawyers with no further costs.

Conversely, when reviewing these existing commercial initiatives, a number of points for improvement can be identified. Both approaches do not manage baggage incidents (delayed, missing and damaged baggage) and their corresponding rights —as we intend to use in the forthcoming future —neither incidents related to service claims (such as irresponsiveness by the airline; bad quality service; misinformation) which beget also disputes and legitimate grounds of redress.

We contend that the contextualized information regarding the procedures to claim and involved institutional entities are out of the spectrum of the provision of these services, information which we assume a priori welfare-enhancing self-litigation and empowering the decision-making process. Also, producing an interface with public and official linking-sources could be of added-value (e.g. meteorological bulletin website to check the weather conditions to assure of the claimed adverse weather conditions; or other sources to rely in case of the event of strikes, security risks or political crises).

From the parameterised procedure we may concede they do not comprehend overall legal framework, case law, best practices nor links to official legal sources. The respective websites include a long list of frequent asked questions for more informa-

⁵ *Ibid.*, p. 51.

⁶ <http://www.flightright.com/>

⁷ <http://www.getairhelp.com>

tion if needed, in order for the end-user possibly find his answer; and if the question is not listed, the user is invited to contact directly the respective customer service or the ticket counter. Further, as commercial initiative, these websites are limited to provide help in the cases of their interest.

It is worthwhile to mention that the (EC) Regulation establishes minimum standards of assistance and compensation for passengers affected by denied boarding or by long delays or cancellations, regardless of the fact of an actual damage. Hence, passengers shall retain the right for further claims beyond this minimum standard, as the national legislators can go beyond the compensation rules established by the Regulation. In this regard, Article 12 stipulates that passengers are not hindered from further claims, if the damage occurred exceeds the compensation awards as under Art. 7. By offering information inasmuch as these service providers are interested, encompassing a monetary estimation may seem reductant.

These services are again of limited help. Their course of action (stage of the process, enforcement of the claim) still leans on each airline's regulation policies and their willingness for settlement; accordingly, only when air carriers are willing to settle with these service providers, the consumer succeeds.

One of the main limitations of these systems relates to the collection of information for enabling any decision: claims and requirements are collected by a fixed-structure template to be filled in by parties, regardless of their own narrative.

3 Ontology-driven support-system

For our purposes, the ontology-based representation of conceptual legal knowledge, which supports legal decision making, proposes: i) an ontological structure aimed at modeling the juridical knowledge related to the ATP domain; and ii) a support-system targeted at exploring the ontological structure in order to provide the specific knowledge to passengers. These components are detailed in the following subsections.

3.1 Ontological structure and ontology requirement specification document

In this sub-section, the development of the Air Transport Passenger Incidents and Rights (ATPIR) is discussed. The first step consists of gathering both domain and development requirements that define the build-up process. The Ontology Requirements Specification Document aims to facilitate the ontology development [8]; in particular, i) enhances the search for available and existing knowledge resources to be reused in the ontology development; and ii) permits the ontology content-verification regarding the requirements that the ontology should fulfill. In Table 1 we present our ORSD of Air Transport Passenger's Incidents and Rights model (ATPIR).

Table 1. Ontology requirements document. Top: Domain requirements. Bottom: Development requirements

<i>ATPIR Domain Requirements</i>

Purpose	Enhancing the decision-making process through an ontology driven support-system. These set of networked ontologies intend to represent relevant information, such as the workflow of a complaint, the foremost incidents in ATP domain and the correspondent rights.
Scope	Air transport passenger incidents and rights.
Sources of knowledge	Containing domain-specific knowledge harvested from normative frameworks: i) Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights; ii) SWD (2014) 156 final, Commission Staff Working Document, Complaint handling and enforcement by Member States of the Air Passenger Rights Regulations (see Fig. 2) iii) The 2011 Report disclosed by the European Parliament, the ECC-Net 2011 Air Passenger Rights Report, the ECC-Net 2012 Annual Report, and the ECC-Net 2012 Alternative Dispute Resolution in the Air Passenger Rights Sector Report; iv) Bureau Européen des Unions de Consommateurs (BEUC) position on Air Passengers' Rights, Revision of Regulation 261/04 on the rights of air passengers in the event of denied boarding, cancellation and long delays; v) Case-law from the European Court of Justice; vi) Terms and conditions of 10 air carriers; vii) As further step, it will contain a thorough analysis of passenger complaints regarding this these domain.
Ontology Requirements I:	<i>a) Functional requirements: competency questions which refer to the particular knowledge to be represented by the model:</i> 1) Does the passenger presents a relevant incident? 2) Which is the procedure to follow in case of a dispute? 3) How can the passenger lodge a complaint? 4) Which are the documents the passenger needs to sustain the claim? 5) To whom to address the claim? 6) When is the passenger eligible for redress? 7) Which are the passenger's rights in case of flight cancelation, delay and overbooking? 8) Which is the applicable legislation?
Ontology Requirements II:	<i>b) Non-Functional Requirements</i> 1) The ontology supports scenarios in the English language. 2) The ontology is based on European legal framework.
Conceptualization	It is a specific set of networked ontologies which represents knowledge related to a particular domain.
Intended End-Users	User 1. Air carriers; User 2. Passengers; User 3. Stakeholders (Regulators, Nebs, ECC-Networks)
Intended Uses (use -scenarios)	Use 1. Support-system for enhancing decision-making; Use 2. Mobile application; Use 3. Before a Complaint; Use 4. To lodge a complaint.
<i>Development Requirements</i>	
Methodology approach	The ontology development methodology is based on a bottom-up approach; is use-case oriented (knowledge sources for concepts and term extraction from official structured legal expert texts and legal sources, and in the further

	future, from a corpus of passengers complaints); anchored in asocial-legal perspective.
Reuse	Reuse of concepts from LKIF-Core, Geomaps, Prov-O

3.2 Formalization

This subsection presents the knowledge base of the Air Transport Passenger Incidents and Rights. ATPIR was designed in a formal model that describes the incidents and its circumstances, tackles the complaint processing workflow and is acquainted with the applicable regulations. The ontologies reuses or maps to concepts defined in other related vocabularies such as the provenance ontology (PROV-O)⁸, the LKIF core ontology [7] or Geonames⁹. The permanent, resolvable IRI of these ontologies is shown in Table 2:

Table 2. Ontologies and their IRIs

Ontology	prefix	IRI
Flight Incident	atpir-fi	http://purl.org/NET/atpir-fi
Complaint Workflow	atpir-cw	http://purl.org/NET/atpir-cw
Flight Incident Legal Framework	atpir-filf	http://purl.org/NET/atpir-filf

1. *Complaint Workflow Ontology* defines a workflow upon which a passenger might bring a complaint when a dispute arises in a complete and valid way. It comprises the iterative steps, such as a) submitting the complaint, avoiding this way irresponsiveness of the airline; and b) adding proof documents (and which) to sustain the redress request; it specifies the standard complaint format and the involved parties in the management of a complaint. In this integrative way we may tackle complex and tailor-made handling procedures, evading from difficulties encountered by passengers in enforcing their rights due to ill-defined, contingent and burdensome complaint-handling processes.
2. *Flight Incident Ontology* expresses the flight disruptions that frame the air transport dispute market: a) baggage incidents (delayed, damaged, and missing); b) flight incidents (delayed, cancelled, denied); and c) service incidents (unfair commercial practises, bad quality service and irresponsiveness), which may reveal if the passenger has a case and thus is eligible for redress (discouraging unmeritorious complaints). A class hierarchy, with a high level classification, is shown in Fig. 3. The class diagram in Fig. 3 and Fig. 4 follow the Unified Modeling Language convention (UML).

⁸ <http://www.w3.org/TR/prov-o/>

⁹ <http://www.geonames.org/ontology/>

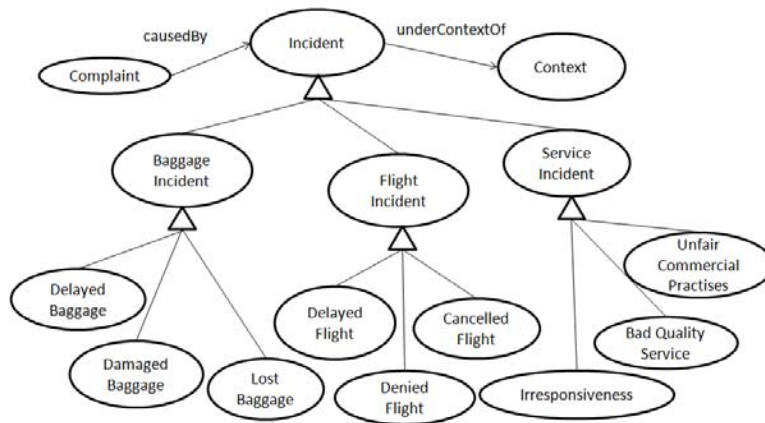


Fig. 3. Categorization of air transport passenger flight incidents

3. *Flight Incident Legal Framework Ontology* models the rights-based approach. *PassengerRights* group encloses the entitled rights related to cancelled, denied and delayed incidents, as defined both in the EC Regulation and in case-law (*Information, Assistance, Rerouting, Compensation, Reimbursement and Return*) and defines when and how the rights are applied. Subclasses of *Sources* will refer to the companies' policies, combined with the existent legal framework (EU Air Transport Law), which is compounded of the EU Regulation, Communications and the case-law from the ECJ (see Fig. 4).

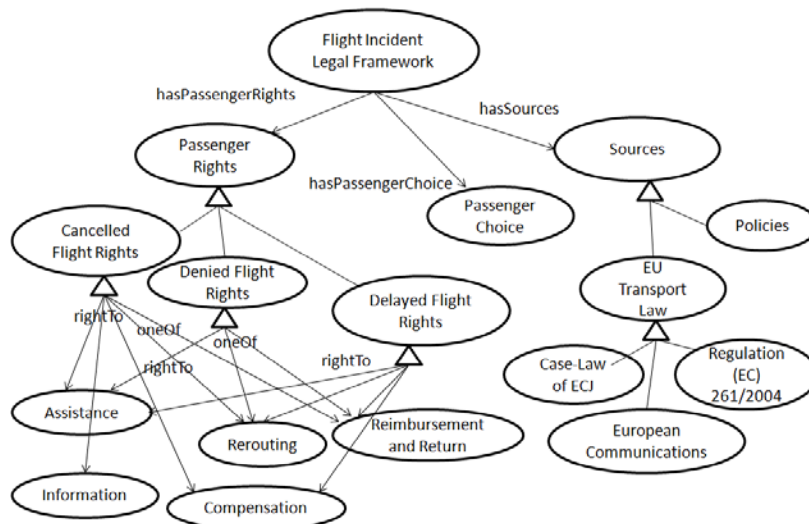


Fig. 4. Class hierarchy for the Flight Incident Legal Framework

3.3 Case-Study

The narrative of the case refers to the context of a real-life complaint¹⁰:

It consists in a cancelation of a flight regarding the air carrier Anonymair, with the flight number 7473, from Eindhoven, departure time at 10.50h a.m. to Porto, with the estimated arrival time at 12.25h p.m., on the 25th of March of 2012. The passenger received an email on the same day, at 9.45h a.m., from the air carrier, stating that the flight was canceled due to extraordinary circumstances, due to adverse weather conditions. In this email was declared the possibility to rebook free of charge a flight to the same destination, subject to availability. The provided flight occurred in the next day and departed from Maastricht. The consumer argues about the transport costs, accommodation and meals.

According to the construal of the legal framework, and as an early instantiation, we consider that the case falls under the scope of the (EC) Regulation (it is a Community carrier) and that the passenger has grounds for redress regarding¹¹:

1. Assistance, cf. Articles 9(1)(a), 9(2), which consists of meals/refreshments, and telecommunications (two telephone calls, telex or fax messages, or e-mails); in the event of rerouting, which is our case, when the reasonably expected time of departure of the new flight is the following day, it shall be offered accommodation and transport between the airport and the place of accommodation, cf. Article 9(1)(b) and 9(1)(c).
2. Information as a written notice setting out the rules for compensation and assistance and the possible alternative transport, Article 5, (2) and Article 14(2).
3. Choice between: (a) Refund within 7 days, Article 7(3) or (b) Re-routing, under comparable transport conditions, to their final destination at the earliest opportunity or at a later date at the passenger's convenience, subject to availability of seats.

3.4 Enabling a technological application

This ontology-driven application would encode the most relevant elements in the incident as instances of the OWL classes in the ontologies referred in subsection 2.3: passenger, air carrier, flights, airport of the incident etc. These instances would be duly attributed with OWL datatype properties (like the flight number or departure time) and related to other resources with object properties (for example connecting the flight with a departure and an arrival airport). These linked resources may be Linked Data published from external sources in a well structured manner, allowing some sort of inferences. For example, some aspects of the case study may be codified with the following RDF statements:

¹⁰ Provided by the Consumer Association "DECO" (<http://www.deco.proteste.pt/>). Complaints are mostly company confidential and aren't available for broad publications, or they are not officially reported.

¹¹ It should be stated that the airline was not obliged to provide compensation in case of extraordinary circumstances, which are events that cannot have been avoided or foreseen, even if all reasonable measures had been taken, namely circumstances which are beyond the air carrier's actual control, according to Article 5, Paragraph 3, such as meteorological conditions incompatible with flight operation

```

:passenger a Passenger .
:flight7473 a Flight ;
    hasFlightCode "FA7473" ;
    hasAirline :fictionAir ;
    atpir-fi:hasDeparture <http://sws.geonames.org/2735943/> ;
    atpir-fi:hasDestination <http://sws.geonames.org/2756253/> .

```

The flight causing the incident is described with the International Air Transport Association (IATA) code number, the airline or the departure and destination airports. The airport cities are represented with resources published by Geonames, which also asserts the nation for every city. A simple query can retrieve a relevant fact about the incident: whether it happened in an intra-Community flight, or whether it was a long-haul flight or not. The assignment of rights to the user can be done by means of a SWRL rule:

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Incident(?i) ^ hasFlight(?i, ?f) ^ IntraCommunityFlight(?f) ^ hasParty(?i, ?p) ^ CancelledFlight(?f) ^ reasonForCancellation(?x, "Extraordinary circumstances") => rightTo(?p, :assistance) ^ rightTo(?p, :information) ^ rightTo(?p, :refundOrRerouting)

```

The rule reads: "*If the flight is cancelled due to extraordinary circumstances, then the passenger has rights to assistance, information and refund or rerouting*". The rule depends on the provided information (e.g. it is true that there were extraordinary circumstances), but it can help passengers with some information to consider before lodging a complaint, abandoning the actual claim or adjudicating their case in court.

4 Conclusion and future work

So far, regarding our knowledge acquisition process, the elicitation of conceptual knowledge, in which we have supported our modeling decisions, derived from structured normative sources with expert generated content (legislation, case-law, legal expert texts, reports, surveys and policies of the ten airlines).

The ongoing construction process of the ontologies and its formalization will also configure and rely on the analysis of a database of consumer complaints to model the case-scenarios, within a social-legal perspective [9]. The aim of this kind of approach is to provide the needed technology to solve specific end-users needs. In our cartographic line, we will start by encompassing the remaining incidents (service and baggage incidents) and their correlative rights, supported by legal and empirical sources. We will also reuse terms of related legal ontologies, and will link to legal sources and official documents. Further complexity will be added into the ATPIR model with the formalization of other class relationships, other constructs and the incoming ontology population. Exceptional circumstances may be further described and related to external events whenever it is possible. Expert-based ontology evaluation will be regarded, in particular, with legal expert validation (researchers, academics and professionals) and further reasoning capabilities.

We presented the preliminary steps towards the intended ontology-driven support-system for the enhancement of the decision-making process of the disputants, with

semantic capabilities, which is in its groundwork stage with the limitations of an early stage proposal, but it is a footstep in the direction of the semantic web applied in the air transport passengers domain.

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Logical Model of Guilt as a Part of a Structure of Crime

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Abstract. We model guilt as a part of crime using an ontology which is an extension of the LKIF ontology, and to put its elements into context of particular criminal jurisdictions common law and the laws of EU countries codes. Differences between existing multipartite guilt frameworks are analysed. We list entities defining these models. An ontological comparative analysis of guilt frameworks in various jurisdictions reveals 7 types of frameworks. Rules of defeasible reasoning are necessary to decide blameworthiness using justification or excuse arguments as we show on an example.

Keywords: defeasible rules · defeater · guilt · LKIF · structure of crime · mens rea · excuse · justification

1 Introduction

A structure or concept of crime is one of the central issues of criminal law research [1], [5], [37], [43]. A narrower issue is the development of rules, according to which it is decided that a certain person deserves punishment for a certain conduct. These rules are quite different in different jurisdictions and are a subject of study in comparative law [1]. In this paper we represent a top-down approach to legal system development using provisions of criminal codes. By juxtaposing all EU criminal laws we are able to find common legal entities that are crucial for any AI and Law undertaking that strives to model written law. We extend LKIF from a different perspective than that originally designed. We do not focus on the most popular notions among legal practitioners [8]. We focus on the provisions from the general parts of criminal codes, because it is imperative that they are being taken under consideration when inferring about any particular offence.

There are two aspects of a concept of legal guilt. The first one is related to conditions that allow deciding whether an offender is guilty [48], [5] (blameworthy [43]), therefore a binary guilt is a suitable name in this respect. The second legal meaning of guilt is in the context of the infliction of a punishment. Here guilt is evaluated according to mitigating and aggravating circumstances of the crime. We focus on the first aspect. Furthermore we do not analyse aspects connected to other parts of the structure of crime such as *actus reus* and notions describing it, such as omissions or causality. However, sometimes we describe guilt in the context of another part of crime –

justification [6]. We found a useful application for both these notions in the defeasible logic and argumentation theory. Their role in the structure of crime is very similar to the nature and purpose of rebutting and undercutting defeaters.

In this work we deal only with the legal part entering discretionary decisions to charge defendants. With regard to petty crimes, notwithstanding readily demonstrable legal guilt, administrative reasons, and equitable reasons might be as well important in prosecutors' decisions [7].

There are many approaches to guilt and the notions that describe it as moral, linguistic, normative entity, mental state, obligation or basis for punishment [37], [43], [1], [48], [35]. The aim of this paper is to model guilt as a part of crime and to put its elements into the context of a particular EU member state criminal jurisdiction. We expected particular jurisdictions to fall in bipartite, tripartite and quadripartite standard framework categories. The first framework consists of two notions: mens rea and actus reus. The quadripartite one adds two more notions to the bipartite framework: social harm of an act and an addressee of the criminal norm or that someone is excluded from liability. The tripartite framework introduces different categorization of notions. It puts all the mentioned notions into one category of the description of a crime. The other two elements of the tripartite approach are justification and excuse. All of these frameworks are Fletcher's basic variants as described in [37] and are also mentioned by other authors in [5] and [43].

We extend the work of Fletcher [37]. Fletcher did not distinguished many aspects of the structure of crime, therefore, the standard framework categories are not able to cover complexity of national jurisdiction guilt frameworks. After closer scrutiny, we distinguish 7 variants of the basic frameworks. These correspond to models represented in Figs. 2-4 and 6-9. Figs. 1 and 5 come from Fletcher.

A multitude of views on importance and a structure of legal concepts makes it difficult to develop ontology based formalization. Such an attempt is done by us, using LKIF as a basis, however, LKIF lacks justification and excuse concepts [8].

In section 1 we describe the most frequently appearing models of crime to determine the placement of guilt. In section 2 we describe legal theories of guilt to underline the distinction between proposition (psychological) and propositional attitude (normative) entities in the LKIF ontology. In section 3 we provide definitions of the most frequently appearing guilt-related terms. Section 4 provides formalization of our model of guilt and in the following section the reader can find couple of examples of defeasible rules implementing parts justifying and excusing from criminal liability.

2 Structures of crime

Component elements of binary guilt differ depending on a legal system. George Fletcher, after considering the most influential domestic criminal and penal systems, has divided them into three models [37].

The context of the crime is crucial to properly define guilt. In the bipartite and the quadripartite frameworks the notion of guilt is connected with intent and negligence [37]. But as it turns out in section 3 these notions often appear in the tripartite struc-

ture. In the tripartite structure of the offence guilt is frequently an assignment of blame to the perpetrator for violating a criminal norm and that there is no excuse for the behaviour [37], [5], [43], [48]. Here, guilt is a negative set-type notion described by excuses like duress, an excessive self-defence or a mistake of law.

2.1 Bipartite framework

The framework is historically the first and consists of two elements determining guilt, hence the name, meaning actus reus (the external element of the crime) and mens rea (the internal element, guilty mind). Both parts must take place at the same time in order for crime to be committed.

In Fig. 1 we demonstrate that the bipartite model for Belgium, United Kingdom and Ireland fits the Fletcher's basic variant. Legal definitions of crime and provisions describing every part of crime for Denmark, France, Malta, Netherlands and Spain are covered by the extended bipartite model to which exclusion¹ is added (Fig. 2). Elements of guilt are marked by the purple colour.

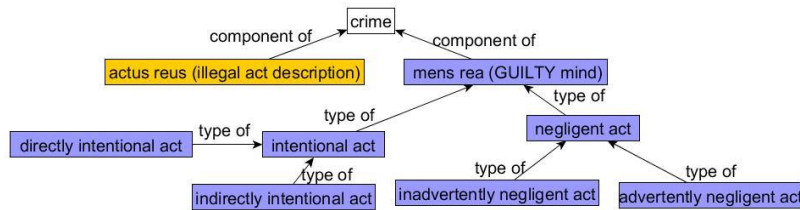


Fig. 1. Ontological model of crime for Belgium, United Kingdom and Ireland.

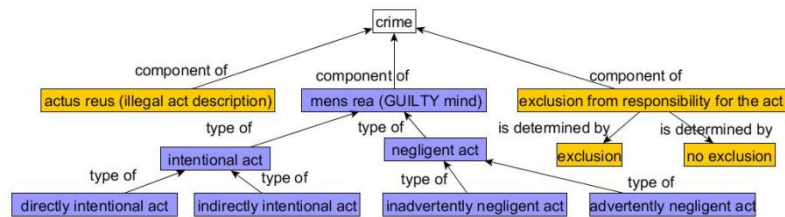


Fig. 2. Ontological model of crime for Denmark, France, Malta, Netherlands and Spain.

2.2 Quadripartite framework

The second approach to modelling crimes is the quadripartite system. Fletcher defines it as a variation of the first model, because still justification and excuse are not core components of crime. The four elements of the crime framework are: (1) the subject of the offence - addressee of the criminal norm, (2) the object of the offence - social harm (3), the subjective side of the offence - mens rea, (4) the objective side of the offence - actus reus.

¹ Exclusion is a situation when an addressee of the norm is excluded from the jurisdiction of the criminal law (e.g. psychological illness), therefore it constitutes a separate entity in the model of a crime.

The first new element (the subject of the offence) concerns total exclusions from criminal liability, for example minors. The second new element (the object of the offence) was introduced to put socially important values under state protection. This rationale leads to a conclusion that when a certain conduct, even if in conflict with a criminal norm, does not reach a certain level of social dangerousness, should not be considered a crime.

We did not find a quadripartite model in its pure form, but for Bulgaria, Hungary and Lithuania we extend the model according to legal provisions. In Bulgaria, there exists a very interesting situation, because guilt is defined both through intention and negligence and excuses². Because of the prevailing importance of the social harm underlined in the Bulgarian Criminal Code we classified the structure of a crime as a quadripartite framework.

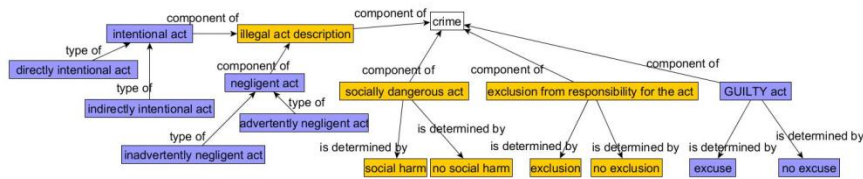


Fig. 3. Ontological model of crime for Bulgaria³.



Fig. 4. Ontological model of crime for Hungary and Lithuania.

2.3 Tripartite framework

The founding idea of the tripartite system is the distinction between description of the offence, wrongdoing (absence of justification) and guilt for the wrongdoing (absence of excuse). The definition of the offence consists of actus reus and mens rea. By moving the psychological factor of intention to the description, this approach can deal with negligent behaviour. The requirement of a violation of a duty of care and the

² Article 11(1) An act dangerous to society shall be considered culpably committed where it is intentional or committed through negligence.

³ The definition of the crime from Bulgarian code that indicates the structure of crime is the following:
Article 9(1) Crime shall be an act dangerous to society (action or inaction), which has been culpably committed and which has been declared punishable by law.

(2) Criminal shall not be an act which, although formally containing the elements of crime provided by law, because of its insignificance is not dangerous to society or its danger to society is obviously insignificant.

foreseeability of the result is now a part of the new approach to guilt - the Normative Theory of Guilt. Negligence is tried by a reasonable man standard and is only a basis for liability if it is expressed in the description of a particular offence [37], [5].

The tripartite framework was originally introduced in Germany and in its basic form can also be found in Austria, Estonia and Portugal. Applying some alterations it is also a working model for the rest of the EU nations.

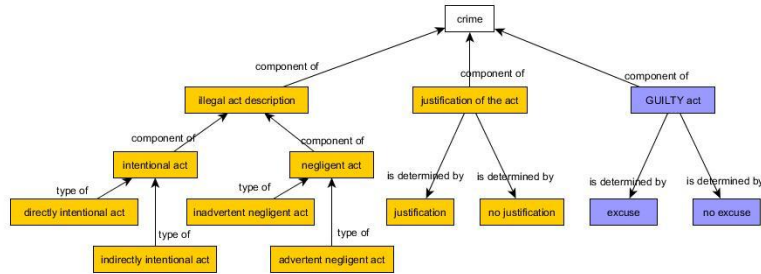


Fig. 5. Ontological model of crime for Austria, Germany, Estonia and Portugal.

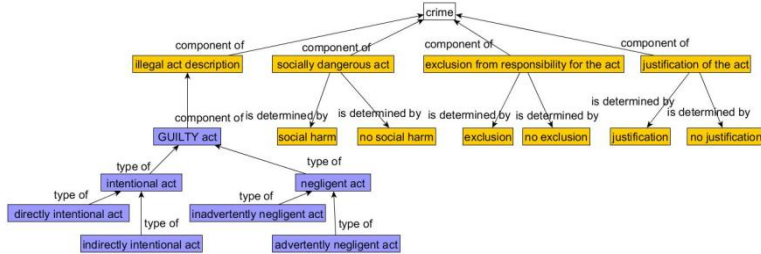


Fig. 6. Ontological model of crime for Greece and Romania⁴.

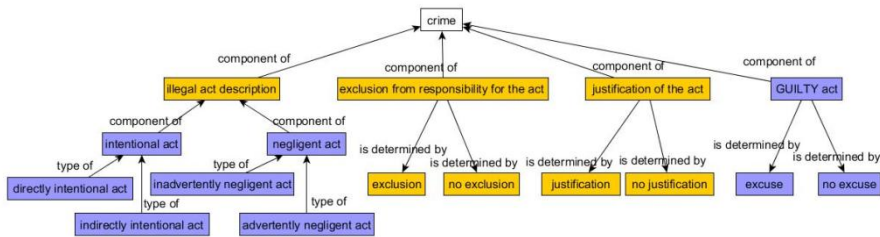


Fig. 7. Ontological model of crime for Italy, Slovenia and Sweden⁵.

⁴ Here are two provisions defining criminal act in Romanian code:
 Art.17 - (1) An offence is an act provided in the criminal law, manifesting a social peril and committed in guilt.
 Art.21 - (1) An act provided in the criminal law committed in the circumstances of one of the justifying clauses provided in the law shall not be an offence.

⁵ In this case, just like for Bulgaria, guilt is both defined as intention and negligence and excuses [42], [31], [17].

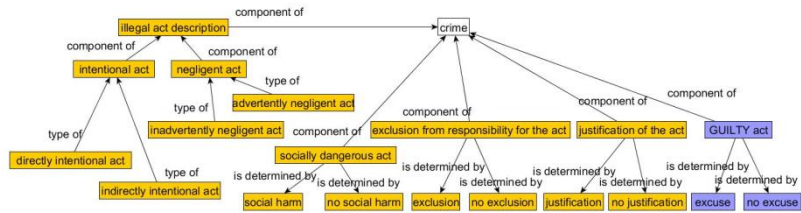


Fig. 8. Ontological model of crime for Croatia, Czech Republic and Poland.

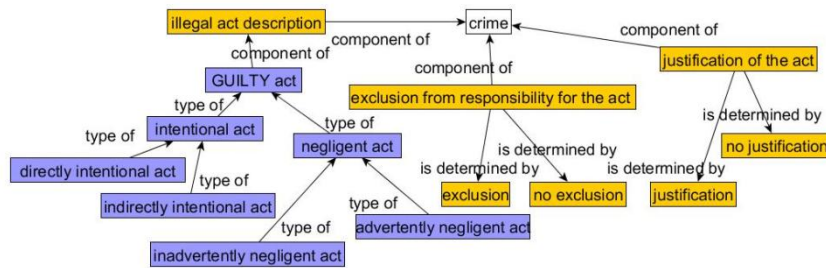


Fig. 9. Ontological model of crime for Cyprus, Finland, Latvia, Luxembourg and Slovakia.

3 Theories of guilt

Having established where guilt can be found in the structure of crime, the attention can be focused on the theories of guilt. For the purpose of ontology development, the most important ones are the Psychological and Normative theories. In LKIF there is a distinction between Proposition and Propositional_Attitude [8]. Intention is a subclass of Propositional_Attitude, and there is even a comment stating that Intent is related to mens rea in the criminal law. The normative approach is not classified as clearly in LKIF ontology, but according to the ontology systematization [8] the normative elements fall under the Evaluative_Proposition class, a subclass of Proposition.

3.1 The Psychological Theory of Guilt

According to this theory only mental, internal states draw borders of blameworthiness for an illegal action. The notion of guilt is reduced to intention, knowledge and consciousness. Reckless or negligent behaviour is outside the model, therefore, crime does not take place or the perpetrator cannot be found liable [37], [43], [48].

In the Fletcher's theory guilt is a positive concept: there has to be feeling in actor's mind. Moving to next tenet, guilt becomes a negative concept - if there are no excuses the actor is being found accountable [37].

3.2 The Normative Theory of Guilt

Because of the mentioned shortcomings of descriptive guilt, German scholars found that it is necessary to blame the offender for not complying with the law. The basis of finding someone blameworthy moved from feelings to a judgement of whether the risk taken was reasonable from an abstract point of view [5]. An offender is punished for not paying closer attention to the circumstances of own actions, for recklessness and negligence [37].

4 Elements of Guilt

All elements of guilt are enclosed by two notions, that is, either by mens rea/the subjective side of the offence (bipartite and quadripartite legal systems), excuse (tripartite legal systems) or both of them at the same time.

In England and Wales there are two basic types of intent: direct (purpose) and oblique (indirect/knowledge). The first one describes a situation of purposeful, desired act aimed at achieving a particular consequence. The latter, describes a mental state of a perpetrator who acts without the direct intent but foresees a possibility that the conduct may be a crime [33].

Another element, but now from the normative perspective is recklessness, which is defined as behaviour causing a socially unjustifiable risk. The notion comes in two flavours: the subjective recklessness (takes place when offender saw the possibility of causing a criminal effect but ignored it [34], and the objective recklessness involves the test of the reasonable man who would have foreseen the risk [9], [41]. In Tab. 1 recklessness is always the subjective recklessness. Offender acts negligently when unintentionally breaking an objective (from law abiding-citizen's point of view) standard of behaviour [33].

In Germany and Poland guilt is defined by the lack of excuses. One of them is the situation of excessive self-defence, where a defendant exceeds the limits of self-defence out of confusion, fear or terror [5]. Another excuse – duress – takes place when someone faces an imminent danger that cannot be otherwise averted than by committing a crime [5], [43]. Subsequent three negative elements of guilt constitute a group of mistakes. The mistakes of justifying and excusing fact are described as a situation when there exists a justified belief on the side of the culprit that there are some circumstances excluding respectively, unlawfulness and guilt of the act. The mistake of law holds when a perpetrator is not aware that the act infringes a criminal norm and that the mistake was unavoidable [5] or justified [43]. Insanity is described as a mental state of not being able to understand meaning of one's behaviour [5], [43].

These are the most frequently appearing elements of guilt. Different legal systems provide with different definitions of the same notions. In Tab. 1 all significant elements of guilt gathered from EU criminal systems are presented. We used Google Translate to translate all the codes that were not in English. There were not many difficulties with understanding the provisions.

Table 1. Elements of guilt as collected from the EU member countries codes

Name of the element	Country	Expressions used, provisions or source (GT if translated by Google Translate)
direct intent	BE, BG, HR, CY, CZ, DK, FI, FR, GR, HU, IT, UK, IRL, LV, LT, LU, MT, NL, RO, SK, SI, ES, SE	'committed the offense voluntarily' (GT), art. 11 (GT), art. 44, 'intentionally' (GT), par. 15 (GT), 'intentionally' (GT), chapter 3 section 6, 'intentionally', 'intentionally' (GT), section 13, art. 43 (GT), [13], [40], section 9, art. 15, 'intentionally' (GT), 'intentionally', 'intentional' (GT), art. 20 (GT), section 15, art. 25, 'intentionally', 'intentionally'
indirect intent	BE, BG, HR, CY, CZ, DK, FI, FR, GR, HU, IT, UK, IRL, LV, LT, LU, MT, NL, RO, SK, SI, ES	'committed the offense knowingly' (GT), art. 11 (GT), art. 44, 'knowingly' (GT), par. 15 (GT), 'knowingly' (GT), chapter 3 section 6, 'knowingly', 'knowingly' (GT), section 13, art. 43 (GT), [13], [40], section 9, 'general intent', art. 15, 'knowingly' (GT), 'knowingly', 'knowingly' (GT), art. 20 (GT), section 15, art. 25, 'knowingly'
advertent negligence	BG, HR, CY, CZ, DK, FI, FR, GR, HU, IT, UK, IRL, LV, LT, LU, MT, NL, RO, SK, SI, ES	art. 11 (GT), art. 45, 'reckless' (GT), par. 16 (GT), 'reckless' (GT), chapter 3 section 7, 'recklessly', 'recklessly' (GT), section 14, art. 43 (GT), [13], [40], section 10, art. 16, 'recklessly' (GT), 'recklessly', 'recklessness' (GT), art. 20 (GT), section 16, art. 26, 'recklessly'
inadvertent negligence	BE, BG, HR, CY, CZ, DK, FI, FR, GR, HU, IT, UK, IRL, LV, LT, LU, MT, NL, RO, SK, SI, ES, SE	'committed by negligence' (GT), art. 11 (GT), art. 45, 'negligent' (GT), par. 16 (GT), 'negligence' (GT), chapter 3 section 7, 'negligence', 'negligence' (GT), section 14, art. 43 (GT), [13], [40], section 10, art. 16, 'negligence' (GT), 'negligence', 'negligence' (GT), art. 20 (GT), section 16, art. 26, 'negligence', 'negligence'
error of fact	HT, CZ, PT, SI	'shall not be culpable', par. 18 (GT), 'excludes intent', 'shall not be held liable (guilty)'
error of law	AT, HR, CZ, DE, PL, PT, SI, SE	'not culpable' (GT), 'shall not be culpable', par. 19 (GT), [5], [22], 'excludes intent', 'shall not be held liable (guilty)', 'excusable'
error of justifying fact	AT, EE, PL, PT	'not culpable' (GT), 'deemed to have acted without guilt', [22], 'excludes intent'
minor	BG, EE, PL	'considered culpable of their acts' (GT), 'not capable of guilt', [22]
mental illness	AT, EE, SI	'not culpable' (GT), 'not capable of guilt', 'shall not be held responsible (guilty)'
mental disability	AT, HR, EE	'not culpable' (GT), 'not be culpable', 'not capable of guilt'
insanity	DE, IT, PL	[5], '(fault) not attributable' (GT), [22]
a profound disturbance of consciousness	AT, EE, IT	'not culpable' (GT), 'not capable of guilt', '(fault) do not answer' (GT)
necessity/emergency	AT, PL, PT, SI	'excused' (GT), [22], 'acts without guilt', 'shall not be found guilty'
coercion/threat/durress	DE, PL	[5], [22]
superior's orders	BG, PL, PT	'considered not culpable' (GT), [22], 'acts without guilt'

5 Formalization

For reasons stated in the introduction to [44] we consider the criminal law as a system that follows the rules of defeasible reasoning. The process of establishing guilt is in its nature argumentation-theoretic [38].

As a matter of fact, all the rules that can be provided by the prosecution on the basis of this theory are defeasible rules - the effect of rules describing mens rea in bipartite system that someone is blameworthy can be rejected by justification or excuse. The defence rules on the other hand are in their very nature defeaters and are often final aim of particular argumentation scheme. More precisely, a strict defeater in the argumentation theory in [44]. If at some level of argumentation a conclusion is that x is guilty of some offence, a justificatory rule works as an undercutter stating that the committed offence is not a proper ground for x being guilty, because (for self-defence reasons) there is, in fact, no offence. It is the reason why rules do not have a not sign before the head, because the head does not take place in the inference chain. If there is a justification for the act, therefore there is no crime and there is no need to check if the actor is guilty of the crime. An excusatory rule is a rebbuter because it negates the conclusion that x is guilty [45], [2]. In LKIF there are rules corresponding to the described defeaters, meaning (valid <rule>) and (excluded <rule> <atom>) [4]. Valid rule works in the same way as the undercutter and excluded rule gives a similar effect to the rebbuting defeater.

The mentioned elements of guilt are rules of defeasible reasoning. They depend on the legal definitions or landmark cases, although, the basic entities which they are composed of are often the same. Below are some definitions of duress from different criminal systems with their place in the structure of crime mentioned. The form of the rule corresponds to the formalism presented in LegalRuleML [2]. They are constitutive rules without modal operators.

To make the rules more expressive, we connected them with the LKIF Core Ontology. As stated in [8] norms can be expressed as LKIF rules and such a connection is possible with some tractability limitations. Every term in the rule can be either an entity (class or object property) from the LKIF Core Ontology, or a framework, a more complex knowledge structures as defined in [8]. Structures of crimes can be described as mereological frameworks. Defeasible rules are constructed using elements of guilt. Frameworks in basic entities are situational frameworks. Part of the implementation of the topics described in this article (structures of crimes, elements of guilt and basic entities) can be found under: https://github.com/jkbno/LKIF_GUILT_ONTOLOGY.

Below there are some examples of rules concerning duress, which under some jurisdictions are justifications and under other are excuses. The structures of crime from section 1 are connected with the elements of guilt by additional rules that play a role of a metainterpreter. If the ontology for a particular country is triggered, then certain elements of guilt are becoming active in the reasoning process. The problem with this solution is that additional rules are needed to connect parts of the ontology of the model of crime with the specific country. Having everything under one ontology causes the Pellet reasoner [47] to throw logical inconsistencies. The examples below

some entities and relations have the same meaning (although using different lexicalizations) and therefore belong to the same class.

Force, Coercion, Constraint are equivalent. The same is for equivalent relations: Resist, -IsAbleToWithstand, ActsUnder, ActsUnderInfluence, respectively.

However, the crucial difference is in the meaning: no infringement, no criminal offence (which are equivalent) and act not criminally liable/act not punishable. In this latter case there is no offence (under the tripartite model) and hence guilt cannot be established.

Article 23 Any act committed under coercion, which the perpetrator was not able to withstand, shall not constitute a criminal offence (Slovenian Criminal Code duress as justification) [31].

con: Person(x), Coercion(y), ActsUnder(x, y), -IsAbleToWithstand(x, y), Offence(v), Commits(x, v) ~> Guilty(x)

Article 122-2 A person is not criminally liable who acted under the influence of a force or constraint which he could not resist (French Code Penal duress as excuse) [12].

con1: Person(x), Force(y), ActsUnderInfluence(x, y), -Resist(x,y), Offence(v), Commits(x, v) ~> - Guilty(x)

con2: Person(x), Constraint(y), ActsUnderInfluence(x, y), -Resist(x, y), Offence(v), Commits(x, v) ~> - Guilty(x)

6 Entities for building the Elements of Guilt

As mentioned above basic entities for building the elements of guilt can either be frameworks or direct entities of the LKIF Core Ontology. All the entities for the elements of mens rea are provided in the Expression Module of the LKIF Core Ontology [8]. Some of the entities for the tripartite approach to guilt were added by us to the LKIF Core Ontology.

The process of distinguishing the necessary entities starts with crossing out all the duplicate terms from the rules. Next step is to check whether some terms are equivalent to other terms, for example acts_under_influence⁶ is equivalent to acts_under and therefore can be crossed out.

For example in rules for duress, the following entities can be described:

Table 2. More detailed concepts and relations for the elements of excuse

able_to_withstand	immediately_before
acts_under	Offence
Coercion	Ordinary_Powers_Of_Human_Resistance
commits	overbears
Constraint	Physical_Violence
evade	resist
imposed_on	Serious_Personal_Violence

⁶ notation is as described in [8].

7 Conclusions

The presented model is an attempt to find and formalize elements of crimes that can be found in many legal systems. It can be used for further development of other parts of crime like actus reus or justification. The ontology of our model is an extension of the LKIF ontology. In the future, we would use LegalRuleML [2], which will provide all the necessary functionalities and features to specify jurisdictions, and temporal attributes. That would reify elements of guilt which without the context of a particular legal system lose their place in the structure of offence.

We demonstrated the ontology use by exploiting its elements in rules defining particular pieces of laws: concerning duress, which under some jurisdictions are justifications and under other jurisdictions are excuses, showing that rules of defeasible reasoning are necessary to decide of blameworthiness. After subsequent investigation of other parts of national criminal codes other appearing notions will be worth incorporating in the ontology.

This work is the step towards automatic guilt determination using the description of crime. The ontology needs to be more detailed (e.g. for excuse relevant more specific concepts need to be added) up to level of terms that will be lexicalized, enabling reasoning.

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14. CC of the Kingdom of Denmark. <http://www.legislationline.org/documents/section/criminal-codes>

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Preface

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This volume collects the four contributions selected for the Second International Jurix Doctoral Consortium, organized in conjunction with the 27th International Conference on Legal Knowledge and Information Systems, held in Krakow on December 10–12, 2014.

This is the second year that JURIX has hosted Doctoral Consortium and the aim is to provide a proper space for young Ph.D. researchers in AI&Law, while encouraging a constructive and fruitful dialogue between the senior scholars and the emerging generation of researchers. The doctoral consortium enables students to interact with academics and experts in the field who can evaluate their research projects from both a theoretical and an applicative point of view. Young researchers have an opportunity to present and discuss their ideas in a dynamic and friendly setting, while the AI&Law community can support the new generation of researchers in carrying forward the interdisciplinary method.

Included here are the five papers from the doctoral consortium: four are selected from the Legal filed and the other from the Computer Science area. In this way we achieve the goal to integrating the two disciplines, so as to firm up the interdisciplinary foundation within the AI&Law community. The topics addressed include legal argumentation and legal reasoning, alternative dispute resolution, legal-knowledge modelling, privacy online social network model.

We would like to warmly thank all students, supervisors, and referees and all the members of the program committee and the organising team, for they have made the First International Jurix Doctoral Consortium a huge success and an excellent opportunity to enrich the AI&Law community with new emerging ideas.

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rOWLeR - A hybrid rule engine for legal reasoning

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Abstract. In this paper rOWLeR, a hybrid rule engine for legal reasoning is presented. The engine combines the expressiveness of rules and ontologies to enable legal reasoning – hence the name “rOWLeR”. It is tailored for use in public administration (tax law, pension law, social benefits law, etc.) and provides a flexible architecture, in particular concerning amendments, which allows for adaptation to different requirements.

Keywords: Rules, ontologies, OWL, legal reasoning, public administration

1 Introduction

The development of rOWLeR is part of the PhD thesis of the author¹ and draws on experiences gained by modelling legal norms with Java and OWL 2. This research tries to fill the gap between the syntactical representation of norms (in XML or other formats) and the need of public administration for a powerful, yet easy to use and customizable legal rule engine. The architecture of rOWLeR is aligned with the semantic web stack and is compatible with LegalRuleML [1], an upcoming standard for modelling legal rules. Present software solutions could be improved, following the theoretical models available.

1.1 Motivation

The use of logic-based knowledge systems² in public administration (e.g. in tax law) dates back to the 1970s in Austria, but there is still no standard or unified methodology for implementation available. Formalization of statutes in practice happens mainly in an ad hoc fashion by the software expert often without considering legal theory at all.

Although the current models of law are rather useful and accepted in practice they have several severe drawbacks. For instance they violate the isomorphism principle in

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² These systems are mostly “production systems” formalizing law by using thousands of if-then-else statements.

a dynamic legal environment which makes maintenance a daunting task. Moreover the legal dynamics (change of law over time) caused e.g. by amendments cannot be handled appropriately. Usually a kind of monotonic reasoning is used which “simulates” defeasible reasoning to some extent. However this approach is very limited in use and can only capture a few aspects of legal reasoning.

The author’s PhD thesis tackles these challenges and claims that legal theory and approaches from AI and Law can improve computable models of law used in practice today. In the long run a flexible framework for building legal expert systems is needed which builds on open standards and implements best practices to foster reuse. Such a framework would also need to be complemented by a unified methodology for formalizing legal norms.

The contribution of this research towards a common framework is the development of a solid temporal model which is capable of handling legal change in an efficient manner, e.g. determining applicable rules according to the temporal relations of the case. This supports the development of clean and well-structured models of law and thus decreases maintenance costs. The technical architecture of rOWler follows a modular approach adhering to best practices³ from software engineering and can be perceived as an extensible framework for building legal expert systems. This complements efforts to acquire an acknowledged standard for the rule layer of the semantic web cake.

2 Architecture

The architecture of rOWler consists of three main layers complemented by an electronic document repository, namely the process layer, the rule layer and the ontological layer. What follows is a short overview of the architectural layers of rOWler, each providing a different view on law and legal rules.

- **Process Layer:** The process layer formalizes the legal procedure and is responsible to handle the dialog between the applicant and the public agency. It collects the relevant facts by automatic and manual means and interacts with the rule layer to continuously provide preliminary results until the final decision. The authorizing person is asked by the system for decision if a “hard” rule should be applied.
- **Rule Layer:** This layer contains the formal rules and the inference engine. It drives legal reasoning by retrieving necessary information like facts from the ontology and providing results to the process layer above.
- **Ontological Layer:** The ontological layer supports the layers above by shallow reasoning on the knowledge base staying within OWL 2, preparing it for more complex reasoning using rules. Especially by data completion, reasoning on mate-

³ This ensures more clean and maintainable code which is at the same time easier to understand and read.

rial circumstances (claims, facts and proofs) and legal concepts by deriving inferences.

- **Electronic Document Repository:** This layer complements the formal model by providing access to electronic documents in Akoma Ntoso [13]. Entities of the other layers, this are rules, concepts, etc., can be linked by using IRIs with legal text. This allows for supporting the decision making by the legal expert by providing statutes, commentaries and judgments as well. Moreover it fosters isomorphism of rules by linking them with their legal basis.

3 Reasoning module and algorithm

Technically the algorithm is encapsulated in a module which integrates the reasoner with the rest of the system and also wraps the temporal model. This thin integration layer is also responsible for deriving the parameters from the facts necessary to call the engine, e.g. the significant date. Often it is required to reason over complex situations which span a longer time period⁴. Such scenarios are handled by the reasoning module which interacts with the reasoner to achieve the overall conclusion.

In the following section the proposed algorithm for reasoning is presented, it has to be mentioned that only a rather sketchy overview is given but no complete logical formalization is provided due to space restrictions.

Basically the algorithm is divided into two separate steps to handle temporal and legal reasoning: (1) Determine which rules are applicable to a case at a certain point in time and (2) apply the rules determined in the first step to the case using defeasible reasoning.

The distinction between temporal reasoning and legal reasoning allows for a separate treatment of both problems. In technical terms each of the steps is encapsulated using an interface with an independent implementation. This approach reduces the complexity of the algorithm by separating the whole problem into smaller pieces, independently of each other, while at the same time fostering better integration, maintenance and testing.

4 Temporal model and reasoning

4.1 Theoretical background

There are several possibilities the legislator can adopt to reduce effort and cost of legal change management [10]. Regardless of the methodology followed by the legislator a computable model of law has to deal with changes of sources of law somehow.

⁴ For example due to the ruling of the Austrian Supreme Court of Justice regarding continuing obligations the time before an amendment has to be judged according to the old rules and afterwards according to the new ones.

For the purposes of the current model we follow the “direct method” of [10] and assume that each change of the sources of law (e.g. by an amendment) leads to a new consolidated version of a statute, containing untouched, modified and new provisions as well. The old version of the statute and its norms enter out of force before the day the new versions enter into force. This approach reduces the complexity of the temporal model.

From a theoretical perspective this may not fully convince as only some provisions are affected by change and thus enter out of force by implicit derogation. However if the legislator enacted an authentic consolidated version of law no such objections exist, even from a theoretical point of view.

To handle change of law two aspects need to be considered: (1) A solid naming convention for statutes and rules and (2) a versioning model which formalizes the temporal dimensions of law.

Due to limited space only the second aspect will be discussed in the next section. It should just be mentioned, that the used naming convention is aligned with FRBR [14] and a simplified version of the HTTP-based syntax for IRIs of Akoma Ntoso [3, 13] compliant with CEN MetaLex [2].

4.2 Versioning model

Temporal dimensions. According to legal theory the temporal model distinguishes the following temporal dimensions of legal norms (cf. [11])⁵:

- Existence: The period in which the norm is part of the legal system, starting with the day of publication (in an official journal), ended by a subsequent normative action.
- Force: When the norm is in force and thus can be applied by the judge in general. In Austria this period usually starts after the day of publication but can be deferred by vacation legis.
- Efficacy: The period in which facts must have occurred in order for the rule to be applicable is called the efficacy period.
- Applicability⁶: This is the period when a legal norm produces the consequences it establishes.

Usually the periods of force coincides with efficacy and applicability of a norm. However it is possible that the effects of a norm start before its force (retroactivity) or continue after the repeal (ultra-activity). For example the tax law of 2008 should be

⁵ It has to be noted, that the terms are not always used homogeneously in literature and are used with different meanings. The terms “efficacy” and “applicability” refer to “Bedingungsbereich” and “Rechtsfolgenbereich” respectively in German legal theory [15].

⁶ This refers strictly to temporal applicability, the derogation of norms, e.g. by EU law, is tackled in the second reasoning step of the proposed algorithm.

applied to the income earned in 2008 (efficacy), even if a case should be decided after the 31st of December (applicability)⁷.

Versioning legal rules. The versioning model used in rOWLer is based on [12] but has been slightly modified and extended to handle not only statutes (documents) but legal rules as well and also to be capable of determining the norms which are applicable to a case at a certain point in time.

The versions of a statute are ordered linearly in so called “versioning chains” by their date of enter into force. When a new version of law is enacted it is added at the end of the chain right after the last version. The model commits itself implicitly that the periods of force of two distinct provisions never overlap. This ensures the soundness of the linear ordering and the versioning chains.

It is assumed that the time when the changes are applied to the legal text coincides with the time of enter into force of the amended provision. Moreover the publication date of the amended provision is assumed to be the same as the amending provision and is also used as the official version date of the act.

Retroactive modifications. Following [12] to handle retroactive modifications the timeline has to be split virtually in the past creating a new legal situation which has not existed originally in this instant in time. To avoid major change of the temporal model in case of retroactive modifications, the proposed solution is enhanced and adopted to avoid splitting of versioning chains.

Each versioning chain is identified by the publication date of the retroactive modification, which is the date from that the chain is valid and hence points at the “current” legal situation. When a retroactive modification arrives, the current chain gets duplicated and the new chain contains the modified provisions starting after the retroactive change is applied.

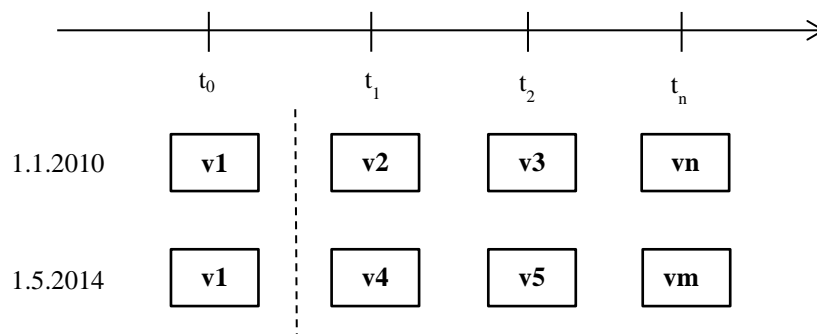


Fig. 1. Example of retroactive modification (adapted from [12])

⁷ For the example we assume that the fiscal year coincides with the calendar year.

Fig. 1 shows an example of an amendment published on 5/1/2014 which retroactively modifies v2 at time t_1 and thus leads to a new versioning chain which contains the untouched v1 followed by the amended versions. Virtually the timeline gets split after v1 which is not affected by the modification, as indicated by the dashed line. There is no need to touch the existing chains. The retroactive change of v2 subsequently leads to an adaption of the following versions as well, thus we get the situation described above.

The versioning chains enable the reasoning engine to query the legal situation before and on (or after) the 1st of May 2014 when the retroactive amendment has been published and became part of the legal system. Further it is possible to refer to the “current” legal situation by assigning a variable to the last chain.

When the current chain needs to be put out of service due a retroactive modification the variable “current” simply refers to the new chain, without affecting the rest of the model. Unlike [12] there is no need to split existing chains in case of retroactive modifications.

4.3 Selecting applicable rules

Based on the versioning model and the reflections made in the previous sections a temporal reasoning engine has been designed which is able to compute the legal rules applicable to a case in a given time. In this step the algorithm deals with the “external” time of norms, which guide the lifecycle of the provision and not the “internal” time which is expressed in the rule itself, e.g. when it is obligatory to use winter tires.

To figure out which rules are applicable to a case the engine needs to take the periods of efficacy and applicability into consideration. Accordingly the temporal model needs to be queried with two dates: (1) The view point of the legal system and (2) the “significant” date of the case used to determine the applicable rules. The latter usually depends on the content and type of law (procedural or substantive law). For instance in criminal law the date when the crime has been committed is significant and hence determines which version of law is applicable to the case.

The algorithm adopted by the temporal reasoning engine of rOWLeR implements five steps and adheres to non-monotonic reasoning. Hence the temporal engine is able to handle suspending provisions as well which block the effects of a norm temporarily. The rest of this section will give a shallow presentation of each step for better understanding.

1. Query existing norms: The first step builds a snapshot of the legal system at view date, which represents the instant in time when the judge has to apply the rules to the case. In technical terms the last versioning chain with a publication date smaller or equal than the view date is selected.
2. Calculate temporal dimensions: The temporal intervals of the norms selected in the first step are fully calculated by using the norm’s static timestamps (startForce, endForce, etc.).

3. Find applicable rules: The third step tries to figure out if a norm should be applied to a case by investigating its dimensions efficacy and applicability. A norm is basically applicable if the view date⁸ is captured by the interval of applicability and the significant date of the case occurs within the interval of efficacy of the rule. Formally this can be expressed as follows: $(t_{startEfficacy} \leq significantDate \leq t_{endEfficacy}) \wedge (t_{startApplicability} \leq viewDate \leq t_{endApplicability})$.
4. Suspension of norms: Sometimes the effect of legal rules is suspended by other norms, to give society the chance to adapt their behavior according to the new provisions. The engine needs to handle such suspending norms in a non-monotonic fashion removing the basically applicable rules⁹.
5. Resolving references: Finally the engine needs to resolve static and dynamic references. From the conceptual point of view references are normative conditionals whose consequences are not deontic but technically include other rules into the current statute. After including the referenced provisions, the algorithm has to be applied to them in a recursive way. The algorithm stops if no more references need to be resolved.

Basically a simple implementation of the algorithm above could stop after the 3rd step to handle many cases. However, a sophisticated implementation may need to handle suspension of norms and the resolution of references as well.

5 Modelling norms

Following Kelsen [6] we assume in accordance with legal theory that norms have basically the following structure: If A_1, \dots, A_2 then B; where “ A_1, \dots, A_2 ” are the conditions of the norm, “B” is the legal effect and “if...then” is a normative conditional. Norms are therefore formalized using rule objects¹⁰ consisting of antecedent and consequent. Technically rules are represented by an interface called `Rule`. With this abstraction in place it is possible to represent the basic deontic notions, including permission, obligation and prohibition, but more complex Hohfeldian concepts as well.

5.1 Presenting rule priorities

In law we have to deal with implicit (*lex specialis*, *lex posterior*) and explicit exceptions between norms. A computable model of law must be able to represent both kinds of exceptions to reflect the way statutes are usually written, organized in general rules and exceptions.

⁸ We assume that the “view date” of the legal system coincides with the point in time when the judge has to apply the rules to the case.

⁹ Therefore temporal reasoning adheres to a kind of defeasible reasoning too.

¹⁰ We use an object-oriented model.

In AI and Law different methods to solve conflicts between rules have been proposed, namely *specificity*, *weight* (salience) and *preference relation*. The model of rOWLeR supports weights and preference relations by using interfaces `WeightedRule` and `PreferenceRelation` respectively.

Conflicts between rules are resolved by ordering rules using an implementation of `RuleOrderingStrategy`. The strategy inspects all rules to order the rules supporting all of the methods above, using explicit and implicit information as well. The rules are placed in a network representing their ranking and wrapped by a dynamic proxy¹¹ at runtime implementing `SuperiorityRelation`.

A `SuperiorityRelation` represents an abstract concept describing the binary relationship between two rules¹², covering specificity, weight and preference relation as well. This abstraction allows for a dynamic creation of arbitrary relations between rules, e.g. of *lex superior* and *lex inferior* by inspecting the law making institutions modelled in the ontology and linked with the rules.

The model enhanced with superiority relations between rules builds the foundation for qualifying the rules as defeater, defeasible and strict in the sense of defeasible logic [9]. Further it enables the use of a defeasible engine like SPINdle [7] for reasoning or the implementation of a custom engine built on an algorithm like [8].

Due to severe space limitations it is impossible to provide more details and to show how deontic rules, metadata and isomorphism are handled by the formal model.

6 Related work

JBoss Drools¹³ is an open-source business rule engine and as such uses production rules as data structure. Since version 6 it is based on “PHREAK” a monotonic algorithm supporting forward and backward chaining.

Although drools performs well with thousands of rules and has a nice declarative style for writing rules, it is not suited for the legal domain. First of all it only supports monotonic reasoning and thus cannot deal with incomplete data. Second the time model of Drools does not support the temporal dimensions of law and thus would have to be extended to handle legal change over time. Compared to Drools, rOWLeR adheres to defeasible reasoning and its temporal model is well suited for the legal domain.

¹¹ The architecture of rOWLeR is consistently based on interfaces which allows for using Java’s dynamic proxying facilities.

¹² In this a sense superiority relation resembles a preference relation but in contrast to the latter it is an abstraction whose instances are built dynamically at runtime by the engine.

¹³ By referring to “Drools” we mean “Drools Expert” which is the rule engine of the Drools platform.

SPINdle [7] is another open-source rule engine which supports defeasible logic and modal defeasible logic as well. Unlike Drools, which is based on a monotonic algorithm, it is capable of defeasible reasoning over theories with thousands of rules. SPINdle gives basic support for time and intervals but cannot handle the temporal dimensions (force, efficacy, applicability) of legal norms. rOWler is built on a sophisticated versioning model supporting temporal reasoning to determine applicable provisions.

The rules in SPINdle are heavy based on literals. Basically the conclusion of a rule is a literal or its negation. To formalize norms we need a representation of a rule which allows for representing richer conclusions, e.g. a calculation or the inclusion of other norms in case of references. Therefore rOWler supports a richer object model supporting different kind of rules which are executed by using an appropriate strategy.

However, it would be nice if SPINdle could be used as defeasible rule engine embedded inside rOWler. rOWler's modular architecture and algorithm would allow for such an integration.

7 Conclusions and future work

Compared to present approaches in public administration, rOWler is aligned with legal theory and fosters defeasible reasoning, while maintaining isomorphism with the sources of law. To cope with legal change over time a solid temporal model has been developed with formalizes the temporal dimensions of law and further is able to decide which norms should be applied to a case at a certain point in time. By using a viewpoint the model is also capable of handling retroactive modification by providing the historic and current version of a statute after the amendment. Present implementations used in practice lack a sophisticated temporal model for handling legal change which increases code complexity and leads to severe maintenance problems.

At the moment rOWler is designed as a single-agent system and the reasoning engine is optimized to deal with statutes with a rather mathematical content like tax law or "easy" cases¹⁴ in the terminology of Hart. However, the model of rOWler is flexible enough to be extended in the future to handle "hard" cases as well, e.g. by providing the legal expert with different alternatives for decision making and integrating more sophisticated argumentation systems like Carneades [4].

In the future the conceptual model needs to be refined, especially with regard to the representation of norms and defeasible reasoning. Feasibility of the theoretical approach should be evaluated by developing a prototype in Java, which has become the "mainstream" programming language nowadays.

¹⁴ "Easy" cases can be largely decided "mechanically" by deducing the required result from the rule and the facts. "Hard" cases are ones for Hart in which the facts fall within the "penumbra" of the meaning of the words in the applicable rule. These cases require the judge to exercise discretion [5].

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Argumentation Schemes as an Effective Tool in cases of Double Taxation

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Abstract. This project description focuses on a specific occurrence of normative conflicts. It addresses the need of deciding the applicable law when conflicting pieces of legislation coming from different legal systems have to be merged. I will check whether and how the argumentation method could help to deal with these cases of normative interactions. Actually, from the logical point of view, the situation described poses some challenging issues, first of all that of taking into consideration contextual reasoning. Furthermore, the task of merging of normative provisions from different legal systems is itself far from being just an automatic activity: merging is not obvious and when it is required in a concrete case, the point is that in principle the systematic character of law cannot allow the legal operator to mechanically combine X from system x and Y from system y. The argumentation method can show its efficacy when reasoning in such situations is often characterized by interpretive uncertainty. The methodology I will follow consists of two main steps: firstly, I outline the legal case study drawn from international taxation law, i.e. juridical double imposition; then, I propose some argument schemes that can exemplify the legal reasoning and the inference chain that lead the legal operator when facing such situations.

Keywords: Argumentation schemes, meta-argumentation, double taxation.

1 Introduction

This paper aims to shortly address a specific legal issue among those that in many subtle ways characterize the fast-growing phenomenon of interactions among different legal systems. The law, far from just being an ordered, hierarchical, formalized and isolated system [7], led by its own (written or unwritten) constitutional rules and modified in compliance with predetermined procedures, is currently undergoing momentous transformations. National boundaries have recently shown a sort of “permeability”: more and more legal standards coming from abroad get into national legal systems fully avoiding the classic legislative processes [8]. Also the coming on stage of new, often non institutionalized, actors plays an essential role in the phenomenon, exerting a strong influence on how the state performs its usual tasks. Actually, states and governments are required to compete not only with many international organizations and supranational authorities, but also with private subjects (multinational com-

panies, nongovernmental international organizations, law firms, and so on), each spokesman of a different interest category [3]. National judicial authorities often play an important role in clarifying the legal picture, exceeding the traditional limits of the judicial power.

If this is the broad legal framework, even though necessarily sketched in a general fashion, what I would like to consider in the next few paragraphs is the specific situation when conflicting pieces of legislation coming from different legal systems need to be merged in order to decide the applicable law. As I will explain further down, I take as a case study the hypothesis of juridical double taxation that can occur in international tax law. The perspective I assume is that of argumentation methods applied to the legal argumentation required in such cases [12], [4]. Actually, the argumentation method can show its efficacy when reasoning in situations of conflict of laws and consequent interpretive uncertainty.

2 Setting the legal scenario: double taxation as a test bed

Governments make use of several criteria to delimit the range of their tax jurisdiction and of their income taxation. Two of the most implemented principles are that of world-wide taxation for residents and that of territoriality for nonresidents holding some income in the territory of the state. Then, governments usually provide their citizens for offsets as regards extraterritorial income. Analogous solutions are adopted for companies. Nevertheless, exactly the fact that often the States opt for competing criteria highly increases the risk of conflicts among laws and especially of international double imposition, i.e. where the same income is taxed by two countries in the same period and by means of the same tax.

Juridical double taxation is currently a matter of high interest, as it is confirmed by the attention periodically paid to the issue by the European Commission (EC). The EC actually considers it a fundamental part of its strategy of addressing the cross-border tax problems within the internal market. Its interventions are intended to limit situations of conflicts between the European Treaties and the bilateral double taxation treaties that Member States have concluded with each other and with third countries.¹

Theoretically, the legislator of a Member State can proceed in many ways in order to draft its tax law provisions in cases characterized by international elements.

- The legislator, in the full exercise of its own sovereignty, can consider one's own provisions exclusively, fueling the high risk of double taxation (as a matter of fact, this is just a theoretical hypothesis, since the ever-growing international relationships force the State to come to an agreement with other States for the benefit of their citizens and companies).
- The legislator can provide for unilateral measures to apply in such cases (e.g. possibility for the taxpayers to deduce what they have already paid abroad).

¹ http://ec.europa.eu/taxation_customs/taxation/company_tax/double_taxation_conventions/index_en.htm (accessed on 13/09/2014).

- The legislator can sign bilateral double taxation treaties (often, shaped on the OECD model tax convention), that usually provide for preferences among different criteria of international taxation in name of the prohibition to tax twice the same income.

Diversified actions are required because “no uniform or harmonization measure designed to eliminate double taxation has as yet been adopted at Community law level”, as the European Court of Justice (ECJ) openly recognized not long ago.² This is also true, more generally speaking, at the international level. The main reason is the (political and normative) sovereignty each State is still capable to exercise in the fiscal area as regards its own territory.

However, the ECJ has changed its opinion on this matter over time. It has progressively taken into consideration that, as a European judicial body and in the light of the current state of EU law, it has no such a power to impose its own fiscal regulation on the Member States. So, from the tendency to recognize the existence of a prohibition of double imposition (appealing to the general principle of nondiscrimination)³ it has ended up accepting juridical double imposition as a still unavoidable restriction to the fundamental liberties (that thwarts the full success of the internal market).⁴ Nevertheless, a recent opinion⁵ seems to bring us back to the first rulings, since the Court has resolved the case referring to the principle of free movement of capitals and the impossibility to limit that fundamental liberty through double imposition.

3 Previous approaches towards conflicts of law and research perspectives

This being the juridical context in the EU, what makes the double imposition issue interesting and challenging from the perspective of legal reasoning is the necessity to deal with the systematic and closed character of two legal systems whose norms are conflicting.

The task of merging of normative provisions from different legal systems is far from being just an automatic activity. In principle the systematic character of law cannot allow the legal operator first to mechanically recognize other State’s legislation and then to combine X from system x and Y from system y, most of all if in system X some term *tx* is systematically defined in other provisions that are not directly involved in the merging operation.

When it comes to solve conflicts of laws within just one legal system, several approaches, dating back to mid-Nineties, have turned out useful [1]: among others, Sartor (1992) [11] and Prakken and Sartor’s (1995) [6] have developed the idea of deriving arguments from the conflicting norms and of making one argument prevail over

² Case C-513/04 *Kerckhaert and Morres* [2006] ECR I-10967 (see paragraphs 22-23).

³ Case C-279/93 *Finanzamt Köln-Altstadt v Schumacker* [1995] ECR I-00225.

⁴ In the subject-matter of free movement of capitals, consider for example the following opinions: Case C-513/04 *Kerckhaert and Morris* [2006] ECR I-10967; Case C-128/08 *Damseaux* [2009] ECR I-06823.

⁵ Case C- 375/12 *Bouanich* (not yet published in the ECR).

the other one through the use of competing principles. These legal principles are a) *lex specialis* (i.e. the specific law derogates the general law), b) *lex superior* (i.e. the higher law derogates the lower law) and c) *lex posterior* (i.e. the recent law derogates the older law), borrowed from the roman interpretive tradition.

All the methods meant to work in just one system are somehow defective once they are shifted to conflicts occurring across states: they do not give adequate tools to comprehend in a unique vision two different styles of interpretation. Indeed, an interpretive principle that can be decisive in one system according to its own legislation may not be accepted in the other.

So, in cases of conflicts of norms provoking double imposition cases, I can identify some characteristics that prevent the use of above mentioned approaches:

- it is necessary to take into account at the same time pieces of legislation coming from different legal systems: each legal system is basically a closed system and the recognition of the foreign norm is not automatic;
- those provisions could be conflicting with one another and the conflict can be genuine or merely apparent, as I will show below;
- the norms need to pass through the interpretation procedure: they need to be interpreted both in the light of international agreements signed by the parties, if existing, and in a systematic way, that in turn may reveal conflicting interpretation of a same term;
- this means that a synthesis of the two systems is somehow required;
- contextual information plays an essential role: only when aware of many factors featuring the concrete situation, it is possible to evaluate the strength of opposite arguments;
- all this contributes to bring about uncertainty and explicit or implicit incoherence.

Even though it has been not yet fully explored, the topic is not new to AI and law scholars. Besnard et al. [2] have recently considered it through the approach of logic-based fusion of knowledge. In more detail, they have investigated the chance to fuse several components of legal knowledge in order to let a standard-logic artificial agent reason about it and, in doing so, considered the Belgian and the French legal systems in comparison to their own bilateral agreement⁶ in the framework of Boolean logic.

Starting from a similar case study, I will adopt a different perspective. As I will show in the next paragraphs, I will apply the argumentation method, in particular considering the possibility of merging different systems and interpretations through meta argumentation schemes in order to find a mechanism able to better deal with the just sketched problems.

⁶ http://www.impots.gouv.fr/portal/dgi/public/documentation.impot?pageId=docu_international&espId=-1&sfid=440 (accessed on 16/09/2014).

4 Conflicting legal provisions: apparent or genuine conflicts

The first step when dealing with normative conflicts is to determine whether they are genuine or simply apparent.

4.1 Apparent conflicts

Let us consider the following case of juridical double imposition⁷ before the Italian Supreme Court. In the later years, C., resident in Italy, has been receiving from Luxembourg a retirement pension for working activity as an employee in the private sector there. According to the Luxembourg legislation, C. has to pay taxes on those pensions to the local social security body. In addition to this imposition, regularly paid, for four years C. has been also subject to the Italian personal income tax (IRPEF) for the same income item. Therefore C. decides to resort to the taxation judicial authority in Italy for the reimbursement of the amounts that he assumes to have wrongfully paid to the Italian Tax Agency (Agenzia delle Entrate). He bases his lawsuit on the Bilateral Convention existing between Italy and Luxembourg.⁸

At the closure of the appeal, the judicial Commission (Commissione Regionale Tributaria dell'Umbria) recognizes that C. is entitled to obtain the full restitution of the amounts paid to the Italian government until then. Actually, according to the interpretation given by the judges, those payments would not be justified in the light of the Bilateral Convention, since pensions would be included in art. 18 par. 2 that provides for as follows: "Notwithstanding the provisions of paragraph 1, pensions and other social security allowances paid by a Contracting State under social security law may be taxed in that State." Therefore, Luxembourg would be the only State entitled to impose the taxation on C.'s pensions.

The Italian Tax Agency files an appeal to the Supreme Court, mainly asserting a wrong interpretation of the convention: the pensions would be encompassed in the par. 1 of the same provision that provides for the taxation in the State of residence. In the alternative, however, also applying par. 2, the pension should be taxed in both States and the State of residence should then apply the mechanism of deduction of what the taxpayer has already paid.

The Supreme Court substantially agrees with the judges of the appeal that the pensions are included in par. 2, though, unlike the previous opinion, the Court holds that also the State of residence is entitled to exercise its fiscal power, since in the conventional provision there is no explicit reference to the adverb "only", as the one in the first paragraph. So, the income item may actually be taxed twice, without any violation of the existing Convention and provided that the State of residence makes available to the taxpayers ways to deduce the amount they have paid to the other contracting state (art. 24). On the basis of these remarks, the Supreme Court annuls the ruling and forwards the case to the court of appeal again.

⁷ Cass. civ., Sez. V, Sent., 03-02-2012, n. 1550.

⁸ Agreement signed on 3/06/1981, ratified by the Italian Parliament with l. n. 747 on 14/08/1982.

In this opinion, the Supreme Court seems to accept the fact that double taxation may happen in the broad context of internationalization, where two or more sovereign States may have the competing legitimate powers to impose their taxation laws. Still, the analysis of the case shows how the conflict here is just apparent. The Bilateral Convention includes a sort of closing rule, art. 24 (“Provisions for the elimination of double taxation”) and it identifies mechanisms to avoid in such cases double imposition that ends up weighing on the shoulders of the taxpayer. Accordingly, Italy, as the state of residence, should allow the taxpayers to detract what they paid abroad.

4.2 Genuine conflicts: Kerckhaert and Morres case

Let us now examine Kerckhaert and Morres case, since precisely on that occasion the ECJ recognized the impossibility to generally avoid juridical double imposition, considering that no uniform law on the matter exists either at the communitarian or international level.

In 1995 and 1996 Mr. and Mrs. Kerckhaert-Morres, Belgian residents, received dividends from a company established in France. In France the gross dividends were made subject to a levy of 15%, deducted at source by way of tax on income. In Belgium, in their tax return, the spouses applied to take advantage of the tax benefit provided for in Article 19. A (1) of the France-Belgium Convention corresponding to the French tax at source. That tax benefit had been withdrawn by the Belgian legislature and therefore their application was rejected. In short, in Belgium the dividends received from a company established abroad are taxed as if they were received by a national company, i.e. at 25% tax rate, without any chance to detract what they have possibly already paid abroad. Belgium definitely applies the world-wide taxation principle to tax its residents and this causes a genuine conflict of norms, even if acceptable in the light of EU law.

The case is paradigmatic under many facets: international elements, exercise in parallel by two Member States of their fiscal sovereignty based on competing principles, no “measures necessary to prevent situations such as that at issue in the main proceedings by applying, in particular, the apportionment criteria followed in international tax practice”. In detail, the country of residence adopts the world-wide taxation principle for its residents, so that all their income has to be subject to the national tax law; whereas the other country considers the territoriality as the leading criterion in order to tax nonresidents holding some income in the territory of the state.

In absence of further specifications in either legislation (e.g. explicit exceptions or unless clauses [10]), the two legal provisions clash and create a juridical tangle, in which the person is actually taxed in both countries for the same income. They can be formulated as follows:

- **Rule 1 (R1)** For all x , if Resident₁ (x) then Pay_Taxes₁ (x) (according to legal system 1)
- **Rule 2 (R2)** For all x , if Receive_Dividends₂ (x) then Pay_Taxes₂ (x) (according to legal system 2)

Where x is every person whose income has to be subject to taxation, *Resident* is the property of having the residence in the country 1 or 2, *Pay_Taxes* is the property of being subject to the tax law provisions of country 1 or 2, *Receive_Dividends* is the property of receiving dividends from a company in either country 1 or 2. Legal system 1 and 2 refer to the legislation of country 1 and country 2 respectively.

In the framework and in absence of explicit exceptions (e.g., deduction measure) in either legislation, the conflict proves to be genuine: people are required to pay taxes in country 1, because of their residence there, and also in country 2 because they have been receiving dividends from a company established in the territory of country 2.

5 Complexity of merging of normative provisions from different legal systems

The European judges have *de facto* returned the hot issue to the senders: first, to the Member States in charge of finding normative solutions to avoid cases of double imposition, secondly, to the national judicial authorities, often the last resort to preserve decent standards of justice. The task of merging pieces of legislation crossing different legal orders actually challenges the national judges because citizens usually look to them in order to see the application of criteria of fairness and equity in the tax field.

Merging is far from being an automatic activity. Indeed, it is not obvious because the law is systematic in nature. In principle, this peculiar feature of the law does not allow the national judge to mechanically combine the norm X taken from system x and the norm Y taken from system y or to know if in X some term tx is systematically defined in other provisions that are not directly involved in the merging operation.

As regards the possible emerging conflicts, they do not simply end in conflicts between norms, but they can actually pertain to the realm of interpretation. It is not rare that two legal systems deal with the same normative provision though different modes of interpretation. So the judge faces one of the two circumstances: 1) conflicts among two interpretations that, considered together, make the conflict actual; 2) conflicts among two interpretations that, on the contrary, help to dissolve the conflict.

The scenario uncovers a set of problems to tackle: a) two opposite arguments, each relying on a rule coming from a different legal system; b) need to analyze both legislations and their interpretive backgrounds; c) need to see whether there is a way to reason with these arguments (meta-argumentation) and try to solve the conflict through the appeal to a general principle.

6 Proposed approach: interpretive argument schemes and meta-argumentation

Going back to Kerckhaert and Morres case, according to Belgium, legal system 1 (S1), the spouses have to pay taxes there, country 1, because of the place of their residence. On the other hand, on the basis of French legal system (S2), they are subject to taxes in France, country 2, because it is where they received the dividends.

Let us try to outline the situation in Table 1.

Table 1. Application of the two rules belonging to the different legal systems. What follows is a sketch of the extended form of both rules. However, the extended version is (here just for Rule R1): 1. For all x , if Resident_1 (x) then Pay_Taxes_1 (x); 2. For all (x) Resident_1 / Resident_1 (p/x) – Universal substitution; 3. If Resident_1 (p) then Pay_Taxes_1 (p); 4. Resident_1 (p); 5. Pay_Taxes_1 (p).

Legal system 1	Legal system 2
Premise 1: Rule 1	Premise 1: Rule 2
Premise 2 (factual): x is resident in 1	Premise 2 (factual): x receives dividends from a company established in 2
Conclusion: x pays taxes in 1	Conclusion: x pays taxes in 2

I could further synthetize as follows: $S1 = R1$; $S2 = R2$; $R1$ is incompatible with $R2$. They are incompatible because of the undesirability of double taxation in the light of the principles of fairness, ability-to-pay and equity shaping tax law. The conflict between $R1$ and $R2$ seems to be unsolvable, since neither rule has the power to defeat the other one. The national judges cannot appeal to *lex specialis*, *lex posterior* or *lex superior* principles because those are effective within the same system.

Things thus standing, the judges can proceed exploring the following possibilities:

- remaining in their own legal system, they can look for a superior normative provision (e.g., a constitutional norm, or a norm drawn from bilateral conventions, as in the Italian case law above considered) that can solve the conflicts;
- in absence of superior norms, they can identify the interpretation that better suits the case and ends up untangling the normative mish-mash (e.g., equity principle: the principles of equity, of ability to pay and of progressive contribution to the public expenses are quite common in EU countries' Constitutions);⁹
- they can consider different ways of interpretation, even coming from different legal systems, and pick the one solving the conflict;
- considering double taxation as a violation of the principle of non-discrimination, they can resort to the European Court of Human Rights (ECtHR), a superior judicial body that enjoys the so called margin of appreciation when interpreting the national laws in the light of the European Convention of Human Rights and can make use of comparative argumentation.

Interpretation gains an essential role and I think that the general structure for interpretive arguments as identified in Sartor et al. (2014) [9] can turn out very useful in this context. The distinguishing elements of this argumentation schemes are:

- an expression E occurs in a document D , E has a certain setting S , relevant to interpretation I , E in D would match this setting by having interpretation I . So, E has to be interpreted as I .

⁹ See for example art. 53 of Italian Constitution, normally read in combination with art. 3 (principle of non-discrimination).

Translated to my case study, E can be R1 stating the world-wide taxation principle for residents and occurring in D, i.e. the tax law of S1. The setting S can refer to the general principle of equity in taxation according to which if an income item, e.g. the dividends received abroad, has already been taxed in another country where it has been produced, it is not subject to the tax law of the country of residence. This setting S exerts relevance on the interpretation I, so that E has to be interpreted accordingly and therefore does not have to be applied. Therefore, following this argumentation scheme (AS from here on) that gives space to the equity principle, the conflict can be solved.

This reasoning, based on meta-argumentation, can be performed by the superior judicial body considering both argumentation schemes as follows:

- R1 and R2 are incompatible.
- S1 = AS X, where R1 and R2 are compatible.
- S2 = AS Y, where R1 and R2 remains incompatible.

These remarks are still introductory and try to identify possible directions of investigation, such as that of meta-argumentation. What I reckon as essential is the role assigned to the national judge who effectively has to find a way out of the juridical deadlock created by the conflicting rules and interpretations. The judges can actually decide to build their own argumentative path starting from two conflicting arguments and assigning strength to each of them according to superior principles or reasons that are substantive to the legal order, this considered in a broad way. But they can also recognize a role to a superior judge entitled to perform some kind of comparative argumentation, i.e. the ECtHR.

7 Research methodology

So far, I have outlined my main research question: which kind of argumentation scheme can help in figuring out a way to compound two or more diverse legal systems and reach a suitable legal solution? Is it conceivable a mechanism able to solve the conflicts occurring also at the interpretive level?

The first phase of my research has been committed to the identification of the substantial research problems. Indeed, I have observed the legal case study of juridical double imposition, where the problem of merging pieces of legislations coming from different legal systems is mostly clear. As a second level of analysis, I have begun to address the theory of legal reasoning regarding the problem considered. I have tried to informally identify the argument schemes in order to later develop a descriptive and prescriptive model of reasoning, exploring the chance to make use of meta-argumentation. The argumentation schemes will be then tested at the theoretical level.

8 Conclusion and future work

The present work is still provisional and tries to address the question about how to find a solution to the conflicts existing among legal provisions coming from different

legal systems using the tools of argumentation theory and meta-argumentation in particular. In doing so, I have considered a case study drawn from international taxation law trying to figure out how the normative conflict can be translated in a conflict of interpretations among which the national judge or a superior judge can choose to reach an adequate legal solution.

My research methodology starts from the empirical observation of the legal problem followed by the description of a related case study. Afterwards, I apply to it argumentation theory tools in order to test their efficacy in dealing with conflicts of laws and conflicts of interpretations.

I have not yet achieved proper research results. Though, I have defined the boundaries of my research, I have chosen a precise research methodology and tried to figure out how interpretive argumentation schemes can contribute to this research field in an innovative way. Future work will include the formalization of the identified arguments through argumentation logics and the investigation on whether and how non-monotonic logic, such as default logic, could provide useful insights and solutions to the problem. As a plausible endpoint, I envision the construction of an argument framework.

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A Privacy Protection Model for Online Social Networks

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Abstract. Online Social Networks (OSNs) have become an important part of daily digital interactions for more than half a billion users around the world. Unconstrained by physical spaces, OSNs offer to web users new interesting means to communicate, interact, and socialize. While these networks make frequent data sharing and inter-user communications instantly possible, privacy-related issues are their obvious much discussed immediate consequences. Recent research identifies a growing privacy problem that exists within OSNs. Several studies have shown how easily strangers can extract personal data about users from the OSNs. There is need for automatic and easy to use privacy protection mechanism. We propose social interaction based audience segregation model for online social networks. Our model uses type, frequency, and initiation factor of social interactions to calculate relationship strength. This model mimics real life interaction patterns and makes online social networks more privacy friendly.

1 Introduction

The Internet has become an inevitable part of lives of people today. Online social networks (Facebook, LinkedIn, Twitter etc) are top most visited sites on internet.¹ These sites are an easy and cost effective way for people to reach out to their classmates, friends and family from across the globe. A large percentage of success of these social networking sites can be attributed to a fact that they give users the opportunity to create their own space and a great way to connect with likeminded people, learn and share knowledge. Online social networks are one of the most popular fora for self representation and user interactions. Individuals join social networks to present themselves. In OSNs user can present themselves by constructing a profile. A profile is a digital representation of an OSN user. A Profile contains huge amount of personal information about the user. According to Grimmelmann [1] Facebook knows an immense amount about its users. A fully filled-out Facebook profile contains about 40 pieces of recognizably personal information, by the time you are done, Facebook has a reasonably comprehensive snapshot both of who you are and of who you know. Additionally, these users are engaged in various social interactions with other users. All these activities are recorded on these platforms which can be easily

¹ Alexa <http://www.alexa.com/topsites>

analyzed, manipulated, systematized, formalized, classified, and aggregated [2]. This poses a serious privacy threat to OSN users, and that is the main reason privacy is a hotly debated topic in research literature [3] [4] [5] [6] [7]. After an extensive analysis of the articles on privacy issues in online social networks, we conclude that OSNs users are unable to control privacy vulnerabilities due to following reasons:

Inflexible Privacy Tools: Privacy tools in online social networks are not flexible enough to protect user data. Most online social networks only allow users to make their data either public or private. Facebook is one of the few online social networks that provide detailed privacy settings. However, privacy interface is too complicated to most of the normal users. The current interface has limited visual feedback, confusing language, and promotes a poor mental model of how the settings affect the profile. Even after modifying settings, users can experience difficulty in ensuring that their settings match the actual desired outcome [8] [9].

Risky Friends: Although friends can enrich the social graph of users, they can also be a source of privacy risk, because a new relationship always implies the release of some personal information to the new friend as well as to friends of the new friend, which are strangers for the user. Online social network users cannot control what others reveal about them. It is possible for information to be passed on without one's consent [10] [11]. For example, Javed and Serena are friends in online social network. Serena is very careful about the privacy. She adopts a policy that conceals all her friends from public. On the other hand, Javed uses a weaker policy that allows any users to view his friends. In this case, Serena's relationship with Javed can still be learned through Javed. We say that privacy conflict occurs as Serena's restrictive policy is violated by Javed's weaker privacy policy. This shows that the user can only control one direction of an inherently bidirectional relationship.

Third Party Applications: Online social networks offer open platforms to enable third party developers to build applications which provide seamless integration of profile data to third party applications. These applications pose serious privacy risk for online social network users because installed applications receive the privileges equal to owner of the profile and can access user's profile data. Third party application developers have access to user's data regardless of the actual application needs. Facebook additionally gives social applications second degree access which means if Javed installs a social application then the application can also request information about Javed's friends and fellow network members. Moreover, users have no control over how third party companies use their personal information [12]

OSN Service Providers: OSN service providers have too much control over user information. The individuals accept terms of privacy policy before creating account on such services. By accepting the terms of the policy, OSN user volunteer to relinquish some known right or privileges they may have. OSN users are unaware of how their personal information is being used, and it is unclear to the users if the OSN is respecting its privacy policy. More-

over, personal information of the user is retained even after the user decide to delete his account. Some of the privacy threat related to OSN service providers are data retention, targeted marketing, selling of data etc [13].

We are addressing risky friends threat to privacy of OSNs users, and propose interaction based audience segregation model for online social networks. The main motivation for this research is providing users with audience segregation model which mimic real life interaction patterns. In everyday life individuals have fine grain control over what kind of information is presented to different audiences. Mirroring similar strategy for online social networks can enhance privacy and give user more control on his personal information. The binary nature of a relationship in OSNs make privacy uncontrollable. The relationship strength is crucial factor to decide what to reveal and whom to reveal. This research is step towards providing OSN users with tools to manage their relationship in similar ways as they do in real life. This doctoral synopsis is organized as follows. Section 2 discusses research problem and identify research questions to address this problem. Section 3 presents preliminary interactions based audience segregation model, and Section 4 covers state of art related to the privacy problem of OSNs. Finally, Section 5 concludes the doctoral synopsis providing directions for future work.

2 Research Problem

Exponential growth of online social networks resulted in fundamental shift in status of end users. Individual end users become content managers instead of just being content consumers. Today, for every single piece of data shared on OSNs, the uploader must decide which of his friends should be able to access the data. In OSNs, term "friend" has become all-encompassing, it has become increasingly difficult for users to control which friends get to see what personal information. Several studies on Facebook usage have shown that the average number of friends per user is approximately 150. Anyone can make a request to join a user's friend circle—family members, colleagues, classmates, acquaintances, strangers etc. Current literature support the claim that users are willing to add strangers to their friend circle [14]. However, allowing strangers to join user's friend circle can lead to a number of privacy risks [10]. Most of the OSNs provide users with binary relational ties (e.g., friends or stranger) [15]. This binary indicator provides only a coarse indication of the nature of the relationship. In reality human relationships are much more complicated than a single binary relational tie. There is need for segregation of friends according to the strength of relational ties. Some of the social networking sites have begun providing friend-lists feature, in order to help users in organizing a large friend network into groups. Grouping several hundred friends into different lists, however, can be a laborious process; on what basis should users construct the friend-lists? And even if the user were to group friends into lists, are these lists meaningful for setting privacy policies? To alleviate the burden of constructing meaningful lists manually, we propose interaction based audience segregation model for online

social networks. The estimation of friendship interaction intensity among OSN users and its classification based on different level of intensity can be quite useful for identifying privacy threat from individuals added as friends. The social web is kind of virtual society that exhibits many of the characteristics of real societies in term of forming relationships and how those relationships are utilized. In real societies, the relationship strength is a crucial factor for individuals while deciding the boundaries of their privacy. Moreover, this subjective feeling is quite efficiently utilized by humans to decide various other privacy related aspects such as what to reveal and whom to reveal. The main question for this research is how interactions of users determine tie strength and implement privacy in online social networks. More specifically, we want to explore whether a user’s interaction with his friends can be used as a basis for making data access decision for that user. To answer this question, we need to understand nature of privacy in online social networks and dynamics of interactions intensity for OSN users. We break main research question into three sub questions:

- How to measure privacy risk associated with social graph of OSN users?
- How to construct interaction graph by quantifying users interactions in OSN?
- How to segregate audience on the basis of interaction graph in OSN?

From our first research question, we quantify the privacy risk attributed to friend relationship in online social networks. We show that risky friends can reveal user personal information unintentionally in online social networks. Second research question deals with user’s interaction patterns in online social networks. We show that users tend to interact mostly with small subset of friends, often having no interactions with majority of their friends in online social networks. This cast doubts on the practice of extracting meaningful relationships from social graphs. We suggest interaction based model for validating user relationships in online social networks. Third research question deals with audience segregation. We consider social interactions as currency to estimate friendship strength and perform audience segregation. Providing users with audience segregation mechanism would improve the quality of interactions and self presentations.

3 Our Approach

We propose interaction based audience segregation model for online social networks. We consider interaction intensity as a proxy for relationship quality. It is used as currency for making data access decisions in online social networks. Current online social networks assume binary, symmetric relationship of equal value between all directly connected OSN users. In real world an individual has relationships of vary quality with his friends. Providing OSN users a mechanism which mimic real life interaction patterns to larger extent would improve self presentation, and reduce privacy risks. It will also enable users to avoid social convergence, and provide users opportunity to present different sides of themselves to different audiences. Our model considers several factors to identify relationship quality such as type, frequency and interaction initiation. We

describe in detail all these aspects of interactions to understand the usefulness of our approach.

The type of interaction is quite important in order to calculate friendship strength because an individual choose an interaction type according to the nature of relationship with its target audience. Hence, the interaction type defines the intimacy, openness, sensitivity as well as strength of relationship between communicating parties. Some of the interaction types are preferred to communicate with close friends, whereas the others to interact with ordinary friends. Hence, all interaction types cannot be given similar weight in estimation of relationship strength. Each interaction type is given a numerical weight in order to increase or decrease its contribution in development relationship strength. Our computation model take into considerations latent as well as active interaction types. The latent interactions are non-reciprocal in nature such as profile visits, whereas active interactions are visible actions such as wall posts and comments. The active interactions can be further classified into real time as well as non-real time interactions. The real time interaction requires the presence of interacting parties and examples of such interaction is chatting. Private messaging and status updates can be classified as non-real time interactions. Apart from active interactions based measures, we can use latent interactions to calculate friendship strength. Latent interactions are more prevalent and frequent in online social networks. Profile visits is a latent interaction and it is very frequent in nature in online social networks. It can be a measure for friendship strength estimation. Mutual friends can be another important measure for friendship strength estimation. Many common friends lead to the fact that individuals are strongly connected with each other, or they share same context such colleagues, family etc.

The interaction count refer to the total number of interactions between an individual and his friends within certain period of time. The frequency of interaction demonstrates the willingness of the user to communicate with his friends. The interaction initiation aspect is very important to understand relationship strength. Some times an individual user is spammed with a lot of interactions initiated by his friends, but his response to that communication determines his willingness to interact. So, we categorize interactions initiation factor in following two ways.

Initiated Interactions These interactions are initiated by the user with his friends. These interactions have more weight in developing relationship strength because the user is willing to communicate and collaborate with his friends.

Received Interactions These interactions are received by the user from his social circle. These interactions have less weight in developing relationship strength because willingness of communication and collaboration is coming from friends. We chose to focus on interactions initiated by the user to limit the inflationary effect of message senders. Some users can artificially boost their status with a particular friend by frequently interact with him.

We consider interactions as a very strong indicator for audience segregation. Our model calculates interaction intensity that can be useful in audience segregation.

4 Related Work

The development of usable, fine grained tools for protecting personal data is serious emerging problem in online social networks. Kelley et al. [16] have done preliminary work towards investigating how users create friend groups in Facebook. They have examined four different methods of friend grouping and their results show that the type of mechanism used, affects the groups created. Their findings lead to a number of recommendations for designing group-based privacy controls for online social networks. Adu-Oppong et al. [17] have proposed partitioning a user's friends into lists based on communities extracted automatically from the network, as a way to simplify the specification of privacy policies. Mazzia et al. [18] built a policy visualization tool that extracts and presents the user's communities to help him in managing his group based privacy policies. Squicciarini et al. [19] [20] propose an approach to facilitate online social network users to group their contacts into social circles with common interests. The authors design a multi-criteria model that takes into account multiple aspects of user's profiles, and automatically groups each user's contacts into social circles with common characteristics. Users in the same social circle (group) have similar behavior, such as similar education background, hobbies, and similar privacy preferences. The authors further propose an approach to recommend privacy policies for newly uploaded data items or newly added contacts. Fang et al. [21] [22] propose the privacy wizard for social networking sites. The goal of the wizard is to automatically configure a user's privacy settings with minimal effort from the user. The wizard is based on the underlying observation that real users conceive their privacy preferences based on an implicit structure. Thus, after asking the user a limited number of carefully chosen questions, it is usually possible to build a machine learning model that accurately predicts the user's privacy preferences. Cetto et al.[23] introduce a serious game that allows its users to playfully increase their privacy awareness on Facebook. The conceptual design of the game is based on two foundations: firstly, an in-depth understanding of privacy awareness as the match or mismatch between perceived and actual visibility of shared items. Secondly, an inductive learning approach that allows its users to experiment and play with their own Facebook data in order to actively learn about the visibility of their personal items.

One of the research studies closely related to our work is done by Lerone et al. [24]. The authors have introduced interaction count based approach to determine relationship strength. In this approach, the authors simply take into consideration three types of interactions and count them in order to calculate relationship strength. The interaction intensity model by Lerone et al. [24] do not differentiate interactions on the basis of initiative, so it is possible that a malicious user intentionally perform larger number of interactions to get access to

user’s sensitive profile information. Our model takes into consideration this issue and resolve it by assign more weight to interactions initiated by user himself. Our interaction intensity model has another advantage over Lerone’s model that we consider all possible type of interactions.

Waqar et al. [25] extend work of Lerone et al. by applying data mining model to calculate relationship strength for online social networks, Whereas, this data mining model is not validated on real OSNs data. The authors also conduct online survey to analyze Facebook user’s interaction behavior with their friends. Xiang et al. [15] propose a model to infer relationship strength based on profile similarity and interaction activity. The authors compute three features to determine profile similarity. These features are: common group, common friends, and logarithms of the normalized counts of common networks. In addition to profile similarity features, the authors consider wall posting, and photo tagging for interaction activity. Our approach is different from their approach because of two reasons: 1. We take into consideration broader set of interactions types. 2. We develop intensity scale for all interaction types. This intensity scale has vital role in computation of relationship strength.

Lizi et al. [26] propose interaction ranking based trustworthy friend recommendation model. This model is able to effectively recommend trustworthy friends to community members by taking into consideration four interaction attributes: reply frequency, comment length, time difference, and domain similarity. Another interesting work by the authors [27] propose trust ranking based recommendation model for suggesting the most trustworthy community members. The authors investigate four new interaction attributes that influence trust in virtual communities. These interaction attributes are interaction quality, seriousness in interactions, consistency over a long period, and common interest. The author’s hypothesis is validated by processing real data collected from Slashdot. A recent work related to friend recommendation is done by Zhao et al. [28]. The authors propose scalable and explainable friend recommendation model for social network systems. This model takes multiple relationship factors into account such as common friends, common followed users, common followers, and common joined groups of the target user and the candidate for friend recommendation. Our research work is not focused on recommending new friends, but identifying the strength of relationship among existing friends.

The majority of online social networks offer second degree access which means a friend of a friend is able to access the user’s personal information. According to Cuneyt et al. [10] friends can be source of privacy risk because this relationship always implies the release of some personal information not only to friends, but also to friends of a friend, which are strangers for the users. Akcora et al.[11] propose a risk measure for OSNs. The aim is to associate a risk level with social network users in order to provide other users with a measure of how much it might be risky, in terms of disclosure of private information, to have interactions with them. The authors compute risk levels based on similarity and benefit measures, by also taking into account the user risk attitudes. In particular, The authors adopt an active learning approach for risk estimation, where user risk

attitude is learned from few required user interactions. Another interesting fact demonstrated by Frank et al. [29] that more users are willing to divulge personal details to an adversary if there is a mutual friend connected to the adversary and the user. Christo et al. [30] show that users tend to interact mostly with small subset of friends, often having no interactions with up to 50 percent of their friends. The authors suggest a model for representing user relationships based on user interactions. Existing research literature supports our idea that all friends should not be give equal access to user personal information, but access to personal information should be administrated based on relationship strength among online social network users.

5 Conclusion and Future Work

We propose social interaction based audience segregation model which mimic real life interaction patterns to larger extent. We also identify the impact of various social interactions available to users in online social networks. There are three main innovative aspects of our model. First of all, it consider all possible of set interactions among friends. Secondly, the model considers the direction of interaction either from user to friend or vice versa. Finally, all interaction types are assigned a numerical weight in order to increase or decrease its contribution in interaction intensity calculation based on its importance in the development of relationship ties.

In future, we plan to conduct formal study of user interaction behavior and sharing patterns. This study will provide us basis for assigning different weight to social interactions and ranking profile items on the basis of their sensitivity. In the next phase, we will develop formal model and proof of concept prototype to validate of our hypothesis.

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Enhancing the decision making process through relevant legal information in consumer law disputes - a case study in air transport passenger rights

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Abstract. This paper aims to describe an initial stage of research related to the introduction of a new completion to the online dispute resolution landscape in consumer law domain. The aim is to include a legal layer into the life cycle of dispute resolution schemes that has not been yet considered. This is part of an intended support-system that aims to provide both consumers and companies with meaningful and relevant domain-specific legal information and awareness about their rights, in order to enhance the decision-making process, to determine the consumer's legal position at an early stage of dispute, avoiding escalation and legal action conflicts. The approach is illustrated by means of a case study based in the area of air transport passenger rights.

Keywords. legal ontologies, information, air transport passenger rights, incidents, complaint, consumer law, online dispute resolution.

1. Research Motivation

This paper contributes to the ongoing discussion of delivering information to foster dispute resolution. We will substantiate the need to provide to the disputant parties relevant legal information regarding their rights in a consumer conflict. Consumer disputes have impacted interest and are often categorized by time-consumption, cost-disproportionality and are convoluted into complex procedures. They comprise acrimonious, since prolonged, legal wrangling which epitomizes long-term damage. Stakeholders (ombudsman, regulators, ADR/ODR providers, consumer associations, among others) assume more palatably that the lack of legal information (the concerned rights) related to the case is linked to the root-cause of disputes [1].

Information disclosure to consumers, as the conventional regulatory tool² to protect consumers and solve disputes, appears to be a classical overregulated domain, deserving much attention by legal drafters, policy and decision makers, and actors in the consumer realm. The classical paradigm sustains a pro-consumer disclosure of

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² The four consumer protection techniques commonly employed in European contract law are (1) mandatory pro-consumer arrangements, which must be part of every consumer contract; (2) mandated disclosure; (3) regulation of entry to and withdrawal from contracts; and (4) pro-consumer default rules and contract interpretation [5].

information which creates obligations upon suppliers to provide relevant information about the rights at stake, in order to make aware and better autonomous choices (as the prototypal autonomy enhancing technique), memorize the “imperfect rationality problem” of consumers, their asymmetric information, their vulnerability (hypo-sufficient laymen), and their biased conceptualization of popular law [2][3].

The theory of behavioral economics embedded in consumer policy³ has been demonstrating that disclosure of information is not sufficient to avoid consumer disputes. It asserts that mandate disclosures are neither read nor used (“non-readership” phenomenon⁴), and they are beyond most people’s interest or understanding, notwithstanding the fact that consumers are bestowed with substantive contractual rights, remedies, disclosures, benefits and cumulative interpretations (that stems from case law, doctrine and European communications, as we will see in our study). A new approach is being considered. Effective, “information-user-specific design” (individual-use information) and “targeted” information disclosure tools are a new re-conceptualized approach. It recalls the principle of relevance: contextualized, situational data, which accounts the informee’s interest [6].

It is a fact that consumers need to have the sophistication to know and access their rights and insist on compliance (empowerment or readiness of consumers, their “smartening”, dispute acculturation or “self-litigation conduct”) but at the same time is required a technological and operational management of the complaint system from ODR providers and/or from the companies themselves who provide services and goods.

This proposal investigates how can a legal layer (in the air passenger rights domain - APR) be designed and incorporated into a decision-support system (into the technological and operational business field)⁵ that may enhance the decision-making process of the disputants. We conceive that such a design may portray a new completion to ODR: a customizing legal knowledge-based support-system that applies and permeates the market - the *locus* where disputes occur and thus, enhance better settlements, redress and replace the balance between consumers⁶ and the company.

³ Behavioural economics shows that people are often altruistic, not fully rational and not independent but tend to reproduce their peers’ choices [4].

⁴ People do not pay attention to standard forms, neither long nor short, in plain language or in legalese, written or oral, separately signed or unified into one document, handed out in advance or *ex post*, See

⁵ In-House Customer Care or Internal Complaint Systems may incorporate this legal cover also in their mass customization strategy. For the purpose of this paper we will only be concerned with the provision of the legal cover; undoubtedly, principles such as impartiality and independence are allocated, but we won’t pursue these matters at this stage. It is a plausible deduction that such a legal incorporation may neutralize and calibrate the pronouncement offered by the internal business policies, which in turn, might improve the market behaviour and will maintain the legal compliance for every stakeholder. This leads us to the consideration that the envisioned legal information system can also reward the economic operators, such as reputable and competitive businesses that render consumer services and goods. As effective consumer policy, recharged with this legal cover, supports the proper functioning of the single market and drives out rogue operators, due to clear legal rules and better coordinated enforcement addressed by the companies. We assert that the market aims good practices to held the consumers allegiance, decrease the number of complaints (reputation and operational costs), which enables systemic accuracy. We contend that this configuration (customer centricity) can be seen as a quick response to the sectorial market problems which can incorporate preventive measures.

⁶ It is foreseen to be a way to support the dispute and its resolution: consumers can determine their legal position (to go ahead with the claim or perceive that there is no case at all) at an early stage of dispute (which can discourage unmeritorious complaints). As such, we assume that consumers may feel entrusted (digital trust in e-society) and aware if the trader is acting in good-faith when filling a complaining and taking decision. Hence, we posit that this approach can avoid escalatory *versus* de-escalatory cycles if not solved in the earlier stage (and foster ulterior phases of mediation) and potentiates the continuation of relationship with the trader. Ultimately we can anticipate that providing the legal cover to the consumer as an early

The paper is structured as follows. We firstly analyze the APR problems and define the research questions. After reviewing previous work in the field, we enunciate the proposed research methodology. In section 6 we provide a description of the legal framework model, then we proceed with its expression as a set of ontologies and in section 7 we conclude.

2. Case-study: Analysis of the Air Passenger Rights Domain

Air transport passenger triggers the top of the consumer complaints ranking in the EU, even after the entry into force of the EU's Air Passenger Rights Regulation 261/2004⁷ (hereinafter Regulation (EC)) that establishes minimum levels of assistance and compensation for passengers subject to denied boarding or affected by long delays or cancellations. This status is affirmed in significant sources. Concerning complaint handling in 2012⁸, a total of 56,478 complaints were received by the National Enforcement Bodies (hereinafter NEBs)⁹ of the EU member-states. In a more comprehensive overview, 38% of complaints are attributed to delays and 38% to cancellations¹⁰. According to the 2011 report disclosed by the European Parliament, the ECC-Net 2011 Air Passenger Rights Report¹¹, the ECC-Net 2012 Annual Report¹², and ECC-Net 2012 Alternative Dispute Resolution in the Air Passenger Rights Sector Report¹³, air passenger transport typifies the industry with the highest rate of disputes, worst reputation and with low resolution rate outside court (airlines are not obliged to

intervention[17] to the conflict, will provide earlier results on impacts on mediation; foster fewer impasses, produce more concessions leading to agreements (more willingness to compromise). These essentials portray other estimable prospects: it may avoid overlapping jurisdictions between different ADR bodies (according to the EU Regulation of ODR) and the burden of proof from the rogue operator is mitigated.

⁷ Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91, JO L46/1 of 17-2-2004. All Articles without special notice refer to the Regulation (EC) No. 261/2004

⁸ SWD (2014) 156 final, Commission Staff Working Document, Document on Complaint handling and enforcement by Member States of the Air Passenger Rights Regulations. The present document reflects the period from 2010 to 2012 (by comparing data, where possible, with the previous reporting period (2007-2009). It thus reflects quantitative complaint handling data provided by the national enforcement bodies (NEBs) for the period from 2010 to 2012, p. 19.

⁹ The Regulation (EC) 261/2004, according to its Article 16, obliges Member States to designate "national enforcement bodies", a body responsible for the enforcement of this Regulation as regards flights from airports situated on its territory and flights from a third country to such airports. Where appropriate, this body shall take the measures necessary to ensure that the rights of passengers are respected. Passengers who believe they have not been treated correctly should contact the body in the country where the incident took place.

¹⁰ The percentage of cases where NEBs launched sanctioning procedures has doubled (2%) since 2011. The top 3 countries receiving most complaints remain unchanged: Spain (15 733) where a great proportion of complaints relates to Spanair ceasing operations, Portugal (6 165) and Germany (5 105), in SWD (2014) 156 final, Commission Staff Working Document, p.19.

¹¹ Available in http://ec.europa.eu/consumers/ecc/docs/ecc_net_air_passenger_report_2011.pdf

¹² It is worth to illustrate that "(...) air transport was at the origin of more than 20% of all complaints (of which luggage issues represented only a minor proportion compared to other issues linked to the denial of passenger rights or unfair commercial practices (...)", p.12, available online in http://ec.europa.eu/consumers/ecc/docs/report_ecc-net_2012_en.pdf

¹³ Alternative Dispute Resolution in the Air Passenger Rights Sector, 2012, by the the European Consumer Centers' Network (ECC-Net), p.2, available online in http://www.ecc.lt/index.php?id=602#.U80gl_mSywd

adhere to alternative dispute resolution schemes due to the fact that they are based on voluntary bases and thus do not provide binding decisions¹⁴).

The ensuing analysis of the air passenger rights settings portrays some of the causes of consumer detriment in the air transport sector. We are cognizant of the reasons¹⁵ underlying this malpractice and failure to provide passengers their rights regarding incidents covered by the Regulation (EC). They stem from: i) existent legal grey areas; ii) unawareness of passengers' rights; iii) complex complaint handling procedures; iv) sanctioning; v) disproportionate financial costs. Concretely:

i) *existent legal grey areas*: lacking definitions, unclear provisions and varying biased interpretations of the text of the Regulation (EC) by the airline industry leave grey zones and loopholes in the passengers' rights, which entail legal inconsistencies and loose standards in the application of the law, leading to the consequent case-law produced to date¹⁶. Most passengers feel that they lack the knowledge and experience to properly enforce their claim, regarding the incidents of cancellation or delay, especially when airlines reject their claim requests or raise a defence of "extraordinary circumstances-excuse"¹⁷ (under those circumstances air companies are released from the obligation to pay compensation) or "reasonable measures" (consists of open textured concepts that require further interpretation in a case-by-case assessment). Generally, passengers cannot verify the accuracy of these kinds of counter-arguments. Often airlines abuse from the excuse of "technical failures" to exclude their liability and it tends to be "accepted" by the passenger. Despite of a proposed legislative revision¹⁸ adopted in 2013 addressing legal uncertainty, only incipient enforcement of air passenger rights in adapting in light of the judgments of the European Court of Justice was perceived¹⁹.

¹⁴ Article 2 of the Directive 2013/11/EU of the European Parliament and of the Council of 21 May 2013 on alternative dispute resolution for consumer disputes.

¹⁵ Air Passenger Rights Revision - Frequently Asked Questions Air passenger rights – summary European Commission - MEMO/13/203 13/03/2013, available online in http://europa.eu/rapid/press-release_MEMO-13-203_en.htm

¹⁶ The most recognized cases brought before the Court of Justice of the European Union (CJEU): case C-549/07 (Wallentin-Hermann), Case C-22/11 (Finnair), C-402/07 and C-432/07 (Sturgeon and Böck) of 19 November 2009, C-581/10 and C-629/10 (Nelson and others vs IATA, KLM, British airways) of 23 October 2012, C-11/11 (Air France vs Folkerts) of 26 February 2013, whose rulings need to be codified by the forthcoming legislation.

¹⁷ Events that are beyond the airline's control, such as political instability, meteorological conditions incompatible with the operation of the flight, security risks, unexpected flight safety shortcomings, strikes affecting the operation of an operating air carrier, natural disasters; Draft list of extraordinary circumstances following the National Enforcement Bodies (NEB) meeting held on 12 April 2013, available online in <http://ec.europa.eu/transport/themes/passengers/air/doc/neb-extraordinary-circumstances-list.pdf>.

¹⁸ In 2013, the Commission tabled a proposal to amend Regulations 261/2004 to improve enforcement by clarifying key principles and passenger rights that have given rise to disputes between airlines and passengers. The text defines the term "extraordinary circumstances" as events which are beyond the actual control of the air carrier and provides non-exhaustive lists of both extraordinary and nonextraordinary circumstances, Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 261/2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights and Regulation (EC) No 2027/97 on air carrier liability in respect of the carriage of passengers and their baggage by air, COM/2013/0130 final - 2013/0072, available online in <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52013PC0130:EN:NOT>

¹⁹ BEUC position paper on Air Passengers' Rights, Revision of Regulation 261/04 on the rights of air passengers in the event of denied boarding, cancellation and long delays, p.2. Available online in <http://www.beuc.org/consumer-rights-and-enforcement/air-passenger-rights>. The European Consumer Organisation (BEUC, stands for French "Bureau Européen des Unions de Consommateurs") is an umbrella

ii) unawareness of passengers' rights: within this industrial realm, the Eurobarometer survey²⁰ discloses that almost six out of ten Europeans (59%) are unaware of their contractual rights and obligations when buying a ticket from an air transport company; but not only the consumers, both airlines, insurance companies and travel agencies are often not sure about the details as well. Besides the existent legal patchwork in APR sector, information requirements, brochures on air passengers' rights are distributed at every major airport of the Community in all official languages and further information is given on official homepages and in mobile applications²¹. Nevertheless, it seems from the number of complaints that many of these requirements or information disclosures are not having their desired effect.

iii) complex complaint handling procedure: it has been observed that passengers encounter difficulties in enforcing their rights as airlines' complaint-handling procedures are ill-defined, contingent and time-consuming, often featured as ping-pong pattern queued cases, which ultimately dissuade consumers from lodging a complaint regarding air travel incidents, or because there is no complaint handling body to turn to in case of irresponsiveness of the air carrier. The parameterized workflow of the complaint diverges according to the air carrier: some contend that only the web-form (their own tailor-made complaint forms) conforms the acceptable and valid complaint; others embrace a more wider perspective of a complaint, such as the ones submitted by fax, email or by letter; most of them require adding of proof documents, eg. invoices, ticket receipt, photos, inventory forms, amongst other documents often demanded, many of those, laymen can not comply with due to lack of on-the-spot information.

iv) sanctioning: the NEB's responsibility for the application and enforcement of passenger rights are only of limited help; they cannot manage individual complaints; they apply different sanctioning policies²² and differently interpret various parts of the Regulation. Inconsistent or insufficiently enforcement and non-effective sanctioning policies by national authorities do not give sufficient incentives for the industry compliance. In this regard, it should be recalled that the sanctioning process is time consuming and can take several years before sanctions are collected (notably in case of appeals);

Conversely, we posit that acknowledging this problems may configure a pre-condition to offer more specific and situated information regarding the guidelines prompted by the emergent consumer policy and the new information design. Hence, the

consumers' group. It brings together 41 European consumer organisations from 31 countries (EU, EEA and applicant countries).

²⁰This research also asserts there is a clear correlation between the passenger's level of awareness of his/her rights and the satisfaction with the services received when travelling by air. The data indicates that the higher the degree of awareness, the higher the quality of services received, see Special Eurobarometer 319 on Air Passengers' rights 2009, Conducted by TNS Opinion & Social at the request of Directorate General Energy and Transport Survey co-ordinated by Directorate General Communication, p. 10.

²¹Information requirements of Article 14 of the Regulation depicts it is the duty of the airlines to provide information in two ways: first there must be a legible notice at the check-in counter where to find the text of the rights in case of a long delay, cancellation or denied boarding; second, in case such inconvenience occurs, the air carriers must provide a notice containing the rights to compensation and assistance to the passengers. In addition, the European Commission distributes leaflets concerning air passenger rights at every airport within the Community, alongside its mobile application for free to check their rights immediately and on the spot <http://ec.europa.eu/transport/passenger-rights/en/mobile.html>

²²Which may include may include inspections, audits, warnings, media contacts, monitoring of websites, meetings with airlines and stakeholders, consultations, pecuniary sanctions, continuing information process, monitoring of the ground handling procedures, amongst others), SWD (2014) 156 final, Commission Staff Working Document, Document on Complaint handling and enforcement by Member States of the Air Passenger Rights Regulations.

relevant and meaningful legal information will focus not only on the rights (if they have grounds to lodge a complaint), but also how to address it and to whom in order to have redress.

3. Research Questions

If ultimately, the stage and the enforcement of the claims regarding the disputes still depends on each companies' regulation policies and their willingness for settlement (as ADR/ODR are dispute resolution schemes are based on voluntary bases and thus do not provide binding decisions) a way to leverage the dispute status could be by endowing busyness with a legal layer. This assertion substantiates the research questions of the current study:

- How can the decision-making process of the users be enhanced?
- How to build a framework design for a decision-support system legally embedded?
- Within a human-computer interaction, how can the design of the decision-support system be user-friendly?
- To which extent the formal constraints imposed by ontological structures imply limitations on the complete and reliable representation and structure of legal knowledge, considering also the legal domain features, such as *i*) accessibility: technicality of legal language; specialization of the law; multi-level jurisdictions; subsidiary laws; legislative updates; *ii*) interpretation of the “terms of art”, polysemy, ambiguity of the open texture concepts, vagueness; *iii*) information retrieval: the fact of cross-referencing of legislation.

4. State of the Art

In current online disputes resolution systems (the so-called “fourth party” referred to the technology component in the dispute management), even though the existence of technological innovation and maturity by the prominent players²³, there are no dispute resolution services (e-government services nor private), nor methods (standard typology encompasses automated negotiation, computer assisted negotiation, online mediation and online arbitration) that provides legal information on the content of the legal rule that applies to a conflict. According to research, ODR experiences show some difficulties [7]. ODR services have not been so widely developed as envisioned, mostly due to lack of funding; lack of enforceability of the achieved agreements and the correlated reluctance from the parties to participate in ODR processes [8], amongst other factors. Moreover, the ODR Regulation 524/2013 primarily continues to rely on procedural rules (the coordination between the ADR entities) without approaching to the substantial content of the dispute, and both their theory and practice are saturated with the inferences of contact and communications theories paradigm. It proposes *i*) a complex procedure: only the complaint is submitted electronically and then it has a three-phase re-routing system not carried out online, but only through traditional ADR methods); *ii*) it is time-consuming: establishes a deadline from 3 up to 6 months for the

²³ Only main industrial experiences are predominant and use dispute resolution technologies. It is recurrently referred as example Colin Rule's assertion about the 60 million cases solved by e-Bay in a single year. Nevertheless, outside big marketplaces there are few business models for sustainable ODR systems .

possible settlement; iii) remains difficult to get an agreement: if parties don't agree with the ADR body/mediator, the process ends; iv) if the dispute is not solved within the offers and counteroffers, there is a "time-out period" due to a dislogical performative structure workflow. Hereby we affirm that ODR is theoretically incomplete and currently related to procedural aspects. We argue that ODR has been developing without its own cogent theoretical base [9] which resides in promoting access to justice and endow consumer protection (empowerment) and redress [10].

Therefore settling agreements "in the shadow of the law"[11], or "in the shadow of procedure" should not be delegated to self-regulation; a pre-emptive step in addressing disputes and complaints would be within the law itself.

According to our best knowledge, there is no ontological representation applied to the APR sector that can describe air transport passenger incidents and endow to the conflictive parties legal information regarding their dispute. Nevertheless, this is not the first initiative in this field. From the point of view of this paper's objective, Flightright's service²⁴ is particularly interesting; it calculates the potential compensation that a passenger might be entitled to in case of cancellation, denied boarding or long flight delay. The procedure of operation of the Flightright is as follows. If there is a positive estimation from the compensation calculator (software module based on an automatic logic), they will manually evaluate the chances of a successful claim collection. If the prospects are promising, thereby they bring the claim forward against the airline, tracking its status. It follows that when every airline does not respond to the demand for payment or declines to pay, Flightright recommends each user to engage the commissioned lawyers with no further costs.

Analyzing the existent initiatives and their clustered boundaries, we foresee how to go beyond and improve our rights-based architecture. In fact, Flightright and other existing companies in the APR domain do not manage baggage incidents (delayed, missing and damaged baggage) and its corresponding rights - as we intend to use in the forthcoming future - neither incidents related to service claims (such as irresponsiveness by the airline; bad quality service; misinformation) which unleashes also disputes and legitimate grounds of redress.

Also, it should be noted that the contextualized information regarding the procedures to claim and involved institutional entities are out of the spectrum of the provision of these services, information which we assume a priori welfare-enhancing self-litigation and empowering of the decision-making process.

They do not comprehend the whole legal framework (case law, national legislation prescribing the rights), nor links to official sources that could confirm, e.g., the alleged weather conditions, strikes, security risks or political crises which entail extraordinary circumstances.

It is worthwhile to mention that the (EC) Regulation establishes *minimum* levels of assistance and compensation for passengers affected by denied boarding or by long delays or cancellations. It states a *minimum standard* of compensation regardless of the fact of an actual damage. Therefore, "further compensation" allows passengers to be compensated for the entirety of the material and non-material damage they suffered due to the failure of the air carrier to fulfill its contractual obligations. Hence, passengers shall retain the right for further claims beyond this minimum standard, through legal proceedings in court. In this regard, Article 12 stipulates that passengers are not hindered from further claims, if the damage occurred exceeds the compensation awards

²⁴ <http://www.flightright.com/>

as under Art. 7. By offering information inasmuch as these service providers are interested, encompassing a monetary estimation may seem reductant.

4) These services are again of limited help. Their course of action (stage of the process, enforcement of the claim) still depends on each airline's regulation policies and their willingness for settlement: only when air carriers are willing to settle with these service provider, the consumer succeeds.

Considering the complexity of the arguments outlined by this powerful industry, the range of extraordinary circumstances, the plethora of initiatives on the legislative agenda on air transport passenger law by the policy-makers (binding or non-binding legal information resources), we may infer that the calculus of the eventual compensation fits only the company's interests.

5. Planned Research Methodology and Future Steps

The research methodology to be followed will consist of: *i*) analysis of the legal framework concerning APR sector, doctrine and case-law; *ii*) conceptual analysis (structuring of the main concepts, from hard and soft law, to build the ontology; *iii*) knowledge acquisition - case analysis and natural language processing on complaints and consumers' requests; *iv*) definition and selection of the decision-making scenarios regarding the typologies of the most known used-cases, according to the previous step; *v*) ontology building; *vi*) end users' tests.

Regarding *the present stage of research*, in order to formalize as ontologies (within an bottom-up approach) the relevant information in the APR domain, different procedures were followed combining analytical and experimental work always considering the end users needs. To this end, hand knowledge acquisition process is described. We gathered information from the ten's largest airlines. To assemble a comprehensive representation of the ten's largest companies, we followed a criteria related to the number of passengers carried, revenue, number of passenger-kilometers flown²⁵. We analysed their current general terms and conditions of carriage (passenger and baggage), their procedures, workflow and their required web-forms alike.

We considered the legal framework related to the air transport passenger domain. We pondered the relevant legislation, including the Regulation (EC) and supporting legislation²⁶; consulting²⁷ and auxiliary²⁸ official documents were accounted for this further analysis, as well as official reports²⁹. Significant case-law from the European

²⁵ American Airlines, Air France, Delta Airlines, Lufthansa, Ryan Air, Air China, amongst others, in http://en.wikipedia.org/wiki/World's_largest_airlines

²⁶ Such as the Communication from the Commission from to the European Parliament and the Council on the application of the Regulation, COM(2011) 174 final; Commission staff working paper accompanying document to the Communication; Communication from the Commission from to the European Parliament and the Council pursuant to Article 17 of the Regulation (EC) on the operation and the results of this Regulation, COM(2007) 168 final; Communication from the Commission from to the European Parliament and the Council: A European vision for Passengers: Communication on Passenger Rights in all transport modes, COM/2011/0898 final.

²⁷ The Commission staff working document: Complaint handling and enforcement by Member States of the Air Passenger Rights Regulations [SWD(2014) 156] and the Public Consultation for the Proposal of revision of the Regulation (EC) (19/12/2011 - 11/03/2012).

²⁸ Auxiliary official documents were also accounted, like the passenger rights EU complaint form and the National competent authorities' document.

²⁹ The following reports: the Special Eurobarometer on Air Passengers' Rights and the European Consumer Centres Network Reports.

Union Court of Justice was regarded to frame the legal framework in APR sector³⁰. From the surveyed data we had access to structured and substantial information pertaining to this sector, statistics of air transport cases and their details, development comparisons concerning previous years, (un)solved cases within ADR schemes, recommendations and conclusions. The manually retrieved information was used to model the scenarios and to populate the ontologies' concepts and their dependency relationships.

Concerning the *steps ahead*, we will continuously describe the processes and the decision-making scenarios in which end users are getting involved, concretely, new typologies of incidents regarding baggage's and service and the correspondent rights, relying in a legal and empirical research (such as a database of complaints). Also as future work, it is aimed to connect the information offered and retrieved from pre-established and structured cases using natural language processing³¹. The obtained domain knowledge will be modeled, refined and represented formally in Protégé via the OWL editor, adding further complexity to the of Air Transport Passenger Incidents and Rights model (ATPIR), as classes, object properties, axioms, and the incoming ontology population.

We will also reuse terms of related legal ontologies, and will link to legal sources and official documents and websites (list of the correspondent NEBS, airline contact list, airline T&Cs, complaint form, list of banned/restricted airlines, official web pages). Legal expert validation (researchers, academics and professionals) will be regarded, as well. In order to combine the plausible information, the support system will express a model with a set of rules (possibly Legal Rule ML) which are in the process of being defined. As a complement, an initial framework implementation follows (as proof of concept tool). A simple application is envisioned that might retrieve from the knowledge base, the specific rights, according to typologies of the most used-cases in APR domain.

6. Formalization

The ATPIR model is created from scratch by eliciting practical knowledge from normative sources and complaints and it is iteratively evolving, describing actual incidents and its circumstances, tackling the complaint processing workflow and is acquainted with the applicable rights.

These pieces of information are unrelated and their analysis was split into three different domains, leading to the definition of three related OWL ontologies. The permanent, resolvable IRI of these ontologies is shown in **Erro! Fonte de referência não encontrada.** and the online documentation expresses the description of the classes, properties and . The ontologies reuses concepts defined in other related vocabularies such as the provenance ontology (PROV-O)³², the LKIF core ontology [12] and Geonames³³.

³⁰ For instance, one right consolidated in jurisprudence (and not in the (EC) Regulation) states that passengers may be entitled to compensation for flights where delay in arrival in 3 hours or more and when the delay is not due to extraordinary circumstances.

³¹ The technical implementation is going to be prompt by InfoCor, a collaborative project held between IDT-UAB and CogniCor, which works within agreement technologies, <http://www.cognicor.com/>

³² <http://www.w3.org/TR/prov-o/>

³³ <http://www.geonames.org/ontology/>

Table 1. Ontologies and their IRIs

Ontology	prefix	IRI
Flight Incident	atpir-fi	http://purl.org/NET/atpir-fi
Complaint Workflow	atpir-cw	http://purl.org/NET/atpir-cw
Flight Incident Legal Framework	atpir-filf	http://purl.org/NET/atpir-filf

i) Complaint Workflow Ontology defines the workflow upon which a consumer might bring a complaint in a valid and complete way when a dispute arises against an airline. It comprises the iterative steps, such as *a)* submitting the complaint to the airline and also to the NEB, avoiding this way irresponsiveness of the airline; and *b)* adding proof documents (and which) to sustain the redress request; it specifies the acceptable standard complaint format and also it identifies the parties involved in the management of a complaint. The defined complaint workflow seems to conform with the general procedure of the ten's largest companies. In this way we may tackle complex and tailor-made complaint handling procedures, evading difficulties encountered by passengers in enforcing their rights due to ill-defined, contingent and burdensome complaint-handling procedures that lack on-the-spot.

ii) Flight Incident Ontology expresses the main flight disruptions that frame the air transport dispute market, such as *a)* baggage incidents (delayed, damaged and missing baggage); *b)* flight incidents (delayed, cancelled, denied flights); and *c)* service incidents (unfair commercial practises, bad quality service and irresponsiveness). These categories seem to encompass the foremost of the complaints as highlighted in the main reports, surveys and case-law. Identifying the main incidents may reveal if the consumer has a case and thus if is eligible for redress (discouraging unmeritorious complaints).

iii) Flight Incident Legal Framework Ontology models the policies and the legal sources that establishes the passenger rights. Even though we modeled rights (as our perspective is user-centric), other deontic modalities are envisioned in the near future, such as sanctions, obligations, prohibitions and permissions. *PassengerRights* group encloses the entitled rights related to the cancelled, denied and delayed incidents, as defined both in the EC Regulation and in case-law (*Information, Assistance, Rerouting, Compensation, Reimbursement and Return*) and defines when and how the rights are applied, depending on a context. Subclasses of *Sources* will refer to the policies of the companies, combined with the existent legal framework (EU Air Transport Law), which is compounded of the EU Regulation, Communications and the case-law from the Court of Justice of the EU. We assume this rights-based approach may attempt to enhance the awareness of passenger's rights and to mitigate the information asymmetry.

7. Conclusion

We consider that applying a technology-assisted dispute resolution support system to this field may constitute a promising approach. The goal of the design of this intended legal support system is the delivery of relevant legal information according to the user's needs (within a social-legal perspective [13]). mainly air transport passengers, airlines, but also other stakeholders, such as NEBs, Regulators, business from the travel sector, consumer centers (like the ECC-Net), in order for them to decide by themselves to lodge a complaint to the airline, to abandon the actual claim or to adjudicate their

case in court. The use-scenarios can be deployed in a mobile application, before lodging a complaint or to lodge a complaint. To achieve this goal, structured normative sources have been demarcated and modeled in ontologies that support existing domain-specific real-world standards.

We presented the preliminary steps towards the intended system and the forthcoming work, which is in its groundstage with the limitations of an early stage proposal, but it is a footstep in the direction of the semantic web applied in the air transport passengers domain.

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Alternative Cross-Border Dispute Resolutions, from the Past to New Computational Methods (IT Realities)

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Abstract. At present, legal proceedings are often delayed, expensive, and characterized by unforeseeable decisions. In this context my objective would be to reduce obstacles to the good functioning of civil proceedings, especially the cross-border ones, by enforcing a method that could improve civil proceedings by means of a new procedure in certain areas of civil law, such as successions and trust, matrimonial regimes, property and lease, company law and consumer law.

Keywords: Alternative Dispute Resolution, ADR, Online Dispute Resolution, ODR, Cross-border Disputes, Equity, Game Theory, Fair Division, Algorithmical tools, Adjusted Winner.

1 Introduction

Nowadays, there are too many obstacles to the good functioning of cross-border civil proceedings in the EU Member States.

First of all, these proceedings take a long time, both to establish them and to obtain a decision, also due to identify and to reach the judge having competence, to translate the summon and the other relevant acts in a language comprehensible to the addressee.

Secondly, cross-border civil proceedings are too expensive for citizens owing to high costs both for documents' translation and for consulting excellent legal experts.

In addition, another obstacle, that citizens have to face to obtain an effective access to justice in cross-border claims, consists in very divergent interpretations, deriving from each national court, even if they apply EU rules. So there is a real need to reach, to the extent possible, foreseeable decisions, especially in consumer disputes.

2 Objective of the research

The goal of my project would be, firstly, the demonstration of the efficiency of certain economic and fair algorithmic proceedings, trying to apply them to the designation of goods or to other issues in a dispute.

According to one of EU purposes – decreasing the recourse to national courts and increasing the use of ADR – my research would focus on the possibility of simplifying and solving disputes as fairly as possible. Thus, obstacles due to divergent national laws would be overcome through an agreement among parties, based on their own willingness (*voluntas*).

This would be, in addition, a step forward for EU consumers: they will be able to solve their contractual disputes online or offline, through out-of-court dispute resolution method.

To summarize, my objectives would be the followings:

1. to insert mathematical algorithmic mechanisms in the solution of certain national and cross-border civil matters, like matrimonial regimes, successions and trust, commercial law, consumer law;
2. to demonstrate the efficiency of this algorithmic proceeding, applying it into the designation of goods or issues in a dispute;
3. to analyze new areas in which this point-allocation procedure could be tried out: first of all, in negotiations involving easily specified issues or well-defined goods. Out of court issues might include a dispute within a company over the division of job responsibilities, or the division of marital property in a divorce settlement;
4. to examine if the procedure might be used in more complex legal areas and/or disputes: a point-allocation procedure could prove very useful in finding a settlement that mirrors each side's most salient concerns;
5. to create a "European common ground" of available rights, which could no longer operate with legal principles, but using these algorithms for a more accurate, faster, cheaper and "envy-free" resolution, to use Brams' words.
6. to create a harmonized procedure able to decide in all EU states, without requiring a change of national rights.

3 Background

In the field of ADR there are too many methods, which are not well used or developed as much as it could be done.

Nowadays a good amount of disputes could be solved applying several “games” for a fair solution for the parties involved.

One of them, as experienced in USA (law and economics), is the patented algorithm “Adjusted-winner” (patented by Steven J. Brams and Alan Taylor on the 9th of November 1999, Patent Number: 5983205).

Fair Division Theory originated in mathematics, and then became a proper branch in the modern social sciences in 1996 with the publication of the book “Fair Division” by S. J. Brams and A. D. Taylor. The recent years have witnessed an increasing interest by the international scientific community, testified by a large number of publications in the field.

I would review existing frameworks and definitions related to fair division and I would provide an updated review of the most important theoretical results, together with a survey of existing procedures and computer algorithms in fair division.

4 An Example

As an example to put into practice an algorithm to solve a dispute: “Suppose Francesco and Paola are dividing three goods between them: A, B, and C. They indicate how much they value obtaining the different goods, by distributing 100 points across them. Assume that Francesco assigns 6 points to good A, 67 points to good B and 27 points to C, while Paola values the goods 5, 34 and 61, respectively”.

Input Preferences

ITEMS	Francesco	Paola
Item 1	6	5
Item 2	67	34
Item 3	27	61
Total	100	100

Among the various proposals for a fair division of the goods, the Adjusted Winner (AW) procedure (a rule to which the contenders comply, possibly with the help of a referee), proposed by S. J. Brams and A. D. Taylor stands out in many ways. This procedure indicates that Francesco should receive a share of 99% of good B, while Paola should get goods A, C and 1% of good B.

This division is:

1. *envy-free* (Francesco and Paola both believe that their portion is at least tied for largest),

2. *equitable* (Francesco and Paola both believe that their portion is valued the same as the other player's) and
3. *efficient* (there is no allocation that is strictly better for Francesco – or Paola – and as good for Paola – or Francesco).

Initial Allocation

ITEMS	Francesco	Paola
Item 1	6	0
Item 2	67	0
Item 3	0	61

Francesco's initial point total: 73

Paola's initial point total: 61

Adjustments

- a. Initially Francesco's point total is greater, so we must transfer some goods to Paola.
- b. Order the goods that Francesco initially receives according to their ratios (x/y where Francesco receives x and Paola receives y) from smallest to largest:
 Item 1 with ratio 1.2
 Item 2 with ratio 1.97
- c. Transfer all of Item 1 to Paola. Francesco's new point total is 67; and Paola's new point total is 66.
- d. To achieve equitability we must transfer part of Item 2 to Paola. Let p be the portion of 2 that will be transferred to Paola. We must solve the following equation for p

$$67 - 67p = 66 + 34p$$

This yields $p = 0.01$.

Calculated point allocation

ITEMS	Francesco	Paola
Item 1	0	5
Item 2	66.34	0.34
Item 3	0	61

Total points assigned to each player: 66.34

5 Hypotheses and Predictions

How is it possible to solve a dispute in a quicker, cheaper and fairer way?

Is it possible to solve a dispute using some economic principles of Game theory?

Is it possible to have specific types of civil disputes a “win-win solution”?

In these cases is it possible to avoid the appointment of a judge or an arbiter, using just an online program, based on economic algorithms?

Is it possible to use this online program to solve cross-border disputes?

The research is aimed to propose an innovative resolution method for cross-border proceedings in Europe, facilitating an equitable dispute resolution.

The project is based on the re-use and/or the development of algorithms on equitable controversy resolution. Some of them were already patented in USA, others are in the process of research, development or patent-pending.

These algorithms will be applied taking account of the distinction between available rights (*droits disponibles*) from national mandatory rules (*loi de police*), in force in the different European Countries.

6 Project Outline

To perform the above objectives, after having experienced these algorithms on various samples, it might be advocated that the European Union should build a platform where citizens will be able to solve disputes obtaining prompt and foreseeable resolution.

Moreover, in conformity with new Directive on alternative dispute resolution and new Regulation on on-line dispute resolution (ODR), this study would provide something new and different in the European context: the adoption of this online procedure could facilitate a faster and cheaper dispute resolution based on parties' agreement and, thereby, avoid difficult problems such as competence and applicable law.

The added value of this project would consist, in addition, in avoiding the recourse to national courts by simplifying and solving disputes as fairly as possible: it will exceed the differences due to national laws on the basis of an agreement among parties, that should be favored and enforced.

Furthermore, this platform could be connected to the planned “EU-wide dispute resolution platform” and/or to the E-Justice Portal, encouraging the possibility of adopting this algorithm both in solving the disputes (ex post), and in envisaging the use of this procedure in negotiating various contracts or obligations (ex ante).

7 Methodology

First of all, the project will start with an overview on ADR nowadays utilized in Europe to solve disputes out-of-courts.

After that, the study will focus on cross-border litigations methodologies. In this field it will be important to discern available rights from mandatory rules.

Afterwards, I am confident that this point-allocation procedure, based on economic fair “game theory”, could be practised in negotiations involving easily specified issues or well-defined goods.

Examples might include a dispute within a company over the division of job responsibilities or the division of marital property in a divorce settlement.

After an experimental phase I would develop, working with a specialized team, the laboratory analysis and evidence needed to support the thesis exposed in this research project, starting from the well known and developed experimental literature on this subject.

More in detail I would run two different experimental phases.

PHASE 1 – Firstly, I would run a battery of experiments aimed at understanding the different role both in terms of efficiency (measured in this setting by the time needed to find a division agreement) and in terms of individual welfare (represented by the absence of envy after the division) of the same “fair division rule” whether proposed by a human being, like the judge, versus a computer.

This would allow me to better characterize the potential of the application of an algorithm to the resolution of this kind of problems.

Phase 1 could include different treatments:

- in treatment 1 it could be tested just a simple ultimatum game (that is a simple proposal of division that could be only accepted or refused) in the two different framings described above;
- in treatment 2 it could be allowed for bargaining;
- in treatment 3 it could be allowed for cheap talking.

Each of these treatments could be complicated by the introduction of different information framings (human being with full information or under a veil of ignorance).

PHASE 2 – Once assessed the validity of automatic procedures in this setting I would test, together with a teamwork, the characteristics again both in terms of efficiency and individual welfare of the different algorithms proposed by game theorists in order to assess if a possible ranking among them exists, also in case of trade off between the two desired characteristics. This will be possibly obtained comparing the different levels of truth-telling versus suspiciousness involved in the bargaining procedure implied by each of them.

If the envisage procedure works well, justified through the above experimentations, it might be used in more complex disputes: a point-allocation procedure could prove very useful in finding a settlement that mirrors the most salient concerns of each party.

In addition, I would suggest that the online platform mentioned above should be built in order to have an easier, fairer, more efficient and more impartial output, from which all citizens will benefit.

8 Significance and Conclusion

The project - concerning the use of electronic mathematical tools - would favour practical solutions regarding actual difficulties in cross border proceedings.

In conclusion, I would improve the use of ADR based on equity, applying game theory's algorithms.

My main target is focused on the cross-border disputes where there are too many problems to deal with, such as conflict of laws, applicable law, international private law principles. I would recommend to use an economic method to solve these disputes, avoiding competence and applicable law problems; obviously without prejudice of mandatory rules of each European country.

Hence, all EU citizens will be able to use this procedure, which will foster the access to justice.

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