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# At Your Service, On the Definition of Services from Sources of Law

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## ABSTRACT

In this paper, we describe our work towards a method for a formal analysis of law. The Dutch Immigration and Naturalization Service (IND) is responsible for the implementation and execution of complex and ever changing regulations. Given the amount of cases to handle, the use of IT systems is a necessity. From 2007 the IND, being aware of their dependence on trustworthy methods to assure the correct implementation of law into their operations and services, have been working on developing an approach that enables them to 'translate' the legal rules expressed in natural language to specifications in computer executable form. In this paper, we will explain this approach and illustrate it with some concrete examples. The work is part of a larger innovation programme initiative that we collaboratively conduct within a virtual collaboration, called the 'Blue Chamber'.

## Categories and Subject Descriptor

### General Terms

Documentation, Design, Reliability, Experimentation, Standardization, Languages, Theory, Legal Aspects, Verification.

### Keywords

knowledge acquisition; legal engineering; legal analysis; service design, knowledge based systems.

## 1. INTRODUCTION

The Dutch Immigration and Naturalization Service (IND), like any other organization responsible for handling a huge number of cases, is heavily depending on the quality of the information systems they use. Typically organizations like the IND use large and complex enterprise IT-systems that contain many different types of functions including client relationship management, monitoring, diagnosis and case assessment. Both the regulations subjected to the IND as well as the context in which this organization operates, are highly dynamic. This leads to frequent changes of high-impact in supporting IT-systems.

In this paper we present an approach that allows us to absorb

changes in legal sources and/or their dynamic context. This approach that is in line with some earlier work, includes the systematic translation of sources of law into computational models. In this paper, we will specifically address the translation of sources of law in natural language into service definitions. This method should help to establish clear relationships between components of IT-systems and the sources of law these systems should effectively implement. Changes in services that should follow from changes in law can be implemented more effectively. Also, the effects of disfunctioning services can be understood in legal terms once we created the explicit mapping between sources of law and the effectuating IT-components.

The development and application of this approach takes place in a living lab, i.e. within an eServices program that aims to digitalize all services of the IND. The use of intelligent services that are distributed over back and front office processes and include cross-organizational service integration, requires reliable and flexible knowledge models and IT-systems of high quality. We will illustrate our approach with some brief examples from the legal domain at hand.

## 2. EARLY WORK

The work described in this paper fits within a series of previous projects. The authors of this paper have been working on some of them. All of these projects have in common that they are attempting to develop a method for a formal analysis of law and consequent translation into a formal representation that can be executed by a computer system, in other words a computational model of law. This translation however is problematic because sources of law contain huge amounts of implicit information. As a result, law can be difficult to understand and to interpret. In countries that have a civil law culture, laws are produced by the parliamentary system, and the sources of law that are produced by legal bodies based on delegated powers are the most important legal sources. In common law tradition, next to the knowledge of 'black letter' law - including bills such as tax law or immigration law - knowledge of a growing body of potentially relevant preceding cases is required for understanding the law. In a civil law country case law is also relevant, but rather as source for explaining the 'correct' interpretation and application of legal sources onto actual cases. Institutions like the IND describe the legal consequences of court decisions in changed regulation rather than taking case decisions as a primary source.

Translating sources of law into formal specifications for IT systems is a necessary step for (partial) automation of public services. This typically is the work of knowledge analysts and

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knowledge engineers. In order to do this work in an industrial setting, i.e. in organizations that work with large-scale IT systems, we need a method that would allow us to work with groups of knowledge analysts and knowledge engineers that have normal professional skills. Furthermore the formal representations resulting from their work should be inter-coder independent, and scalable with respect to human resources. Also the translation process of sources of law should be transparent, in order to make sure that legal and policy experts are able to validate the correctness and completeness of the ‘legal rules’ in the IT system. With our work we step in the footsteps of the founding fathers of computer science. Leibniz and Wilkins e.g. both worked on formal conceptualization and mechanical reckoning [9][19]. Simon and Newell recognized the power of computers as symbol processors allowing them to be used for executing reasoning processes [13] including reasoning about legal cases. Consequently people have been working on using IT systems within the domain of law, particularly within public administrations. In literature, one can find quite some research papers on systems that were aimed at deciding on legal cases. The authors of this paper have also been working on legal decision-support systems in previous projects [2]-[7].

In the POWER-programme [4][5], conducted in the late nineteen-nineties, written sources of law were taken as the main source of (legal) knowledge and as the starting point for analysis and modeling. This focus on sources of law as starting point differed from earlier knowledge engineering approaches that took (legal) experts as primary source of knowledge.

The early work of Sergot et al., which is also within the domain of immigration law, like the work we present in this paper, is a good example of the latter. In his work the expert was the main source of legal knowledge, despite of its title: ‘the British Nationality Act as a Logic Program’ [15][16]. In the POWER-programme [4][5] legal experts did play an important role, but only as interpreters and validators of knowledge that can be traced back to sources of law.

In a series of projects since the POWER-programme, the authors have been systemizing the translation process using (semi) automated norm extraction [10][11][12], particularly by looking at invariant language patterns typically used in written sources of law. Using computational linguistics we were able to identify the most important patterns and showed that we could use parsing to ‘translate’ written sources of law written in natural language into model sentences in a formal language.

In order to become more flexible with respect to different task contexts and to save efforts necessary to remodel for every new task context, we began working on the representation of norms in ways that enable multiple task contexts and multiple agents perspectives. This has resulted in an approach that enabled us to avoid the typical single task orientation used in Sergot et al. In order to achieve this we used formal models [6] that are based upon an extended version of Hohfeld’s model [8]. In previous research projects we have showed that Hohfeld’s initial model already is a big improvement to the traditional interpretation of rights, duties and allowances in (modal) logic [18]. Our extended and completely formalized version of Hohfeld’s model enables us to express all typical jural relations in a formal way, but it also is expressed in a relational model that can be implemented in a straight forward way.

One of the problems when taking written sources of law as primary knowledge source is which (parts of) sources to include.

In one of our recent publications we have described how we can solve this scoping problem and also how to make the act of scoping relevant sources of law explicit [1]. Obviously the method for the formal analysis of law we are working on should be inter-coder independent, and should result in a model that can be mapped to the original sources (like we aimed for in the POWER-programme).

In this paper, we describe the results of our most recent work: improving the connection of the formal models of law to services. We will explain the approach we have developed and illustrate its application to Dutch Aliens Act. We will also discuss some issues that are raised during the analysis and explain the relevance of raising and discussing them with legal experts, legal drafters and policy makers.

### 3. THE NATURE OF PUBLIC SERVICE

Within the Dutch government various large governmental institutions collaborating in the ‘Manifesto Group’, named after a 2003 manifesto in which these institutions express their goal to use IT to improve customer service, have agreed that for public services an event driven service oriented architecture (EDSOA or SOA2.0) would best allow collaboration amongst governmental institutions as well as between governments and private organizations. Such a SOA2.0 is now widely recognized as preferent architecture for firms, public or private.

Both public and private firms should comply with the law. But while private organizations can do anything that is not forbidden by law, public institutions should only do things that have a legal basis. Tasks of public institutions should be entirely based on sources of law. Therefore we need a method that results in a model defining services, products and conditions including specifications for complying to the rules of law. The rules stated by law should be traceable to specifications for the execution of those services.

Laws may give some directives on what services should be delivered. We classify tasks based on the party that is expected to take the initiative:

1. Services that are requested by a client from a public institution that is liable to that request (e.g. applying a residence permit).
2. Services required from a patient by a public institution (e.g. paying taxes)

In the next section we will describe the outline of the entire method that we work on and illustrate that with actual examples. Then we will briefly describe how we can use this as a basis for service specifications as part of that method.

### 4. FORMAL ANALYSIS OF SOURCES OF LAW

Working on a number of cases trying to test prototypes for a formal model of law from written sources, we encountered several problems and challenges. Firstly, the amount of implicit information in sources of law resulted in rather big inter-coder dependency. Secondly, while the discussions we had on legal matters in our multidisciplinary teams resulted in additional knowledge for all experts involved, the representation of the results in relational algebra were not comprehensible for the legal experts, policy advisors and administrative workers involved. Thirdly, discussions in multidisciplinary teams on determining

relevant sources of law in a specific context did not come to a shared conclusion.

To solve these matters, the authors have started a project that is aimed at creating an approach that will solve these issues.

## 4.1 Outline of the method

The method we have developed thus far consists of several steps of which six steps precede the service definition step: Making scripts for defining context (1); Scoping relevant extracts from sources of law (2); Extracting jural relations from sources of law (3); Collecting multi-perspective scenario's (4); Transforming jural relations to relational algebra (5); Generating multi-perspective representations (6).

For step 1, we refer to the work of Roger Schank and Robert Abelson [14]. At this point we use a basic version of their conceptual dependency theory. Our only purpose is to create a context that can be used to assess the scoping of relevant extracts of sources of law. Step 2, the scoping of relevant extracts from sources of law, is described in [1]. Service definition is part of step 3, in which the jural relations are made explicit. Therefore we will elaborate on step 3 further up in this paper. In step 4 we collect multi-perspective use-scenarios. In this step multidisciplinary teams give their input, and the results are described in such way that they are comprehensible for all team members. The method for translating the jural relations into relational algebra, step 5, is presented in [6]. These models represent multiple perspectives and can be used to inform multiple target groups with the results of our analysis. These target groups include: legal experts, policy advisors, administrative workers, knowledge engineers, IT architects, IT designers, and executive management. Step 6 is currently under development.

Our method is based on a multi-layered knowledge representation architecture [6]. This architecture separates structural descriptions and referential mechanisms of sources of law, the institutional elements and structures described by those sources of law (institutional layer), the social structures, roles, behavior and assertions about them (reality layer). Mapping between assertions about 'the world' and legal facts is a process called qualification, which requires commitment of an agent. One does not necessarily has to agree upon the qualification of the assertions, i.e. on the legal facts. We define institutional facts as the join of legal facts and jural relations (see next section).

## 4.2 Explaining jural relations

In step 3 we extract jural relations from sources of law written in natural language text. Jural relations have been introduced by Wesley Hohfeld in 1919 [8]. In [6] we described the method for translating the jural relations into relational algebra. In that paper we also describe how we formally represent jural states. For readers yet unfamiliar with Hohfeld's work we will give a short introduction here.

Jural relations always are paired. Hohfeld distinguished two types of jural relations. Type A: that can create or destroy jural relations, including jural relations of their own kind. The type A jural relations consist of the pair POWER-LIABILITY and their opposite pair DISABILITY-IMMUNITY. The other type of jural relations (Type B) consist of the pair CLAIMRIGHT-DUTY and their opposite pair, the NORIGHT-LIBERTY. Jural relations of type B can not create or destroy other jural relations, but they can be used as constituents of the precondition or postcondition of type A relations. A short description of the Hohfeldian jural relations can be found here:

- POWER-LIABILITY; Person A (actor) has the POWER to ACT on subject matter M and Person B (patient) has the corresponding LIABILITY to be forced into a newly created legal relation with Person A (actor) or a third party. A POWER-LIABILITY creates one or more new institutional fact(s) (a postcondition), but can only do so starting from one or more defined preconditions.
- DISABILITY-IMMUNITY; Person A (actor) has an IMMUNITY on subject matter M leaving person B (patient) with a DISABILITY on M. A DISABILITY-IMMUNITY creates one or more new institutional fact(s) (a postcondition), but can only do so starting from one or more defined precondition(s).
- CLAIMRIGHT-DUTY; Person A (actor) has a DUTY on subject matter M to person B (patient) that has a CLAIMRIGHT to M.
- NORIGHT-LIBERTY; Person A (actor) has a LIBERTY on subject matter M and Person B has NORIGHT to interfere with that LIBERTY.

In our approach jural relations are modeled as objects. Our conceptual meta-model consist of set of connected worlds, whose access relations are formed by legal acts. Each of these worlds consists of sets of institutional facts that hold at a certain point in time. This allows us to describe legal cases as well as potential scenarios.

## 5. CASE STUDY: FOREIGN STUDENTS IN THE NETHERLANDS

We will now step by step illustrate our approach by taking an actual piece of legislation that we translate into a service model. The example is the case of foreign students that want to study in the Netherlands and apply for legal residence. The first question that we have to answer is a scoping issue: what rules of law apply to the student and the IND? To answer this question we start with making a sketch of the use context we are interested in. The purpose of this sketch is to have a reference that enables a decision on the legal scope of the analyses.

The sketch of the use context in this paper is about IND services to international students that want to apply for a study in the Netherlands. The roles that can be identified in sources of law related to the use context are: international student, the Minister responsible for immigration (Our Minister), IND-employee, the sponsor of the international student.

### 5.1 Scoping relevant extracts from sources of law

In [1] we give an elaborate description of the procedure for scoping sources of law. Here we'll give a short outline.

Using the sketch of the use context that we introduced in the previous section, we take one article that is relevant to that use context. Which starting point we take will not matter because of implicit cross-references between elements of sources of law. Our hypothesis is that all legal sources relevant in a specific context are interrelated. We have as yet found no proof to refute this hypothesis. For scoping we use the following procedure: select an acting person (this can also be an organization) and describe the context of the acts of the agent (1); choose a starting point for the analysis: a legal statement that contains a condition and is relevant in the chosen context (2); perform a linguistic analysis of a selected sentence (3); transform the text to the active voice, thus

ensuring the subject of the sentence is an acting person (4); identify explicit references and terms that need a definition (5); select words or constituents that contain or might contain an implicit reference. Make these references explicit, or make an explicit decision that further analysis is not relevant in the chosen context (6); analyze all the selected words and constituents, starting with point 2 of this procedure (7); the procedure ends when all relevant references analyzed, the decision to end the analysis is being made by a multidisciplinary working group in which legal experts, policy advisors, and practitioners are represented (8).

The reader must be aware that the linguistic analyses (step 3 of the procedure) for the example cases described below have been conducted manually. The authors aim at supporting this step by automated devices in the near future and have worked on automated tools for the analysis of legal sources in the various previous projects [10][11][12].

Applying the procedure will result in normalized model sentences with explicit actors, patients, subject matters, conditions and references to sources of law.

## 5.2 Extracting jural relations from sources of law

The content of each article that is considered to be relevant for our use context is extracted following a strict protocol. Obviously we register the reference to the source of law as we will need that for tracing, explaining and maintaining our formal models of law.

Within each article we close read every sentence. Within these sentences we search for an active agent (actor) and a passive agent (patient). The jural relation between the actor and patient is expressed in related pairs (POWER-LIABILITY; DISABILITY-IMMUNITY; CLAIMRIGHT-DUTY; NO RIGHT-LIBERTY) and a subject matter M. As stated before we model jural relation as objects. Type A objects must be characterized as objects that potentially can change other objects and thus can be structured as reified functions, having a precondition and a postcondition. The precondition describes the condition for establishing the postcondition. Both are expressed in terms of institutional facts. The postcondition describes the institutional facts that results from executing the jural relation, i.e. function.

In legal texts necessary variables of jural relations are often left implicit: one or both agents may be not explicitly mentioned. Also precondition or postcondition may be left implicit. Implicit components of jural relations mostly can be found in other sentences within the collected set of sources of law. When only a CLAIMRIGHT-DUTY relation, or a NORIGHT-LIBERTY relation are explicit in sources of law, it is likely that there is an implicit POWER-LIABILITY that gives the person possessing the DUTY the POWER to fulfill a CLAIMRIGHT (and destroy the jural relation) or the person with a NORIGHT the POWER to create the LIBERTY. These implicit jural relations are necessary to create a formal model that does not contain loose ends.

For the purpose of this paper we will use English translation of a selection from the set of relevant articles from sources of law. We will limit ourselves to the issue of legal residence on the ground of a residence permit for a fixed period, referred to in article 14 of the Dutch Aliens Act. The residence permit for a fixed period, referred to in article 14, is substituted by the term: 'residence permit'.

### 5.2.1 Examples of jural relations in sources of law

The foreign student that wants to study in the Netherlands, comes to the IND for legal residence. Article 8, Aliens Act declares that having a residence permit gives the alien the LIBERTY to have legal residence, which leaves the other, passive party in the jural relation based on this article with a NO RIGHT.

Our Minister is not mentioned in article 8, but there is an explicit reference to article 14, which gives Our Minister the POWER to grant, to reject, or disregard the application for a residence permit. The alien is the explicit actor holding a LIBERTY in article 8, and the implicit patient holding a LIABILITY in article 14.

Article 16, paragraph 1 and under a, states that: "An application for the grant of a residence permit may be rejected if: the alien does not possess a valid entry visa with a purpose of residence corresponding to the purpose of the requested residence permit."

The (implicit) actor of this sentence is Our Minister, who has the POWER to reject the application of a residence permit. The patient, who has LIABILITY, is the alien who is applying for a residence permit. The legal act is rejecting. The subject matter is the application of a residence permit.

The precondition of this POWER-LIABILITY relation consists of the following constituents: the institutional fact of an existing application for the grant of a residence permit AND the absence of an institutional fact that the alien possesses a valid entry visa AND the absence of the DISABILITY-IMMUNITY relation that gives IMMUNITY for the POWER to reject the application of a residence permit because of the lack of an entry visa (described in article 17 of the Aliens Act).

The postcondition of the execution of this POWER-LIABILITY relation consists of the institutional fact of the rejection of an existing application for the grant of a residence permit AND the creation of the DUTY-CLAIMRIGHT relation to make the decision known to the person with the LIABILITY (described in article 3:41 of the General Administration Act).

## 5.3 From formal model to legal services

We use the ACTS that are connected to the executing of a POWER-LIABILITY or a DISABILITY-IMMUNITY as starting point for our service model. Examples of a POWER-LIABILITY that triggers a legal service are e.g. applying for a residence permit, the granting of an application for a residence permit, rejecting an application for a residence permit or making a decision known to the applicant. We conceptualize a legal service as a realization of a function that is a response to a legal act.

Sources of law often do not provide all information relevant to the persons that have to realize such services. It can be the intention of the legislator to leave space for stakeholders that have a role in the execution of law. This gives space for taking economical and pragmatic issues into account, issues that we will not further address in this paper. The IND is a good example of a public administration that has a role in deciding upon an effective service design. This service design is also impacted by whose interest it is to effectuate a certain legal effect and related to this; who should take the initiative. In [17][18] we address how to model social contexts in which agents operate within a world governed by (legal) norms.

## 6. CONCLUSIONS AND FUTURE WORK

In this paper we present the results of persistently working on a method that can be used for specifying large-scale IT systems that

implement (legal) rules. The extraction of jural relations from sources of law results in a comprehensive scheme. It reveals implicit information hidden in the original configuration of sources of law. The jural relations also give us the handles for identifying the services that are implied. The steps in our method and particularly the procedures that reduce inter-coder dependency are major improvements compared to existing design methods.

As for future work we aim at using NLP-techniques, comparable to the work of Emile de Maat [11].

We will continue our efforts to develop a method that can be used in the complex practice of building and maintaining large-scale IT-systems that implement (legal) rules. It is our hope and ambition that once we will be able to have a method that will enable us to specify legal knowledge in such way that one can use that specification in all possible task contexts without having to recode it. Governments could then make these specifications available to all, thus improving legal services to their clients.

## 7. ACKNOWLEDGMENTS

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