Modelling Semantic Profiles in Legislative Documents for Enhanced Norm Accessibility

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ABSTRACT
In this paper an approach to the Semantic Web in the legal domain is discussed: it is obtained by modelling legislative document semantic profiles using a model of normative provisions. An implementation of this approach through RDF/OWL able to describe provisions and their relations is presented. In particular, an implementation of Hohfeldian legal fundamental relations between provisions, as well as reasoning example by using the proposed approach is shown.

General Terms
Legislative Document Semantics, Provision Model, Domain Knowledge, Hohfeldian Reasoning, OWL-DL, SPARQL

1. INTRODUCTION
In the legal domain the availability of advanced information and reasoning services is particularly desirable for the complex nature of the legal document workflow, as well as for the peculiarities of legal users’ information needs. A possible effective solution can be found in the implementation of the Semantic Web concept.

In this paper an approach to the Semantic Web for the legislative domain is discussed. It aims firstly to identify (Section 2) and modelling (Sections 3, 4, 5) legislative documents semantic profiles by a model of normative provisions. In particular, based on such modelling an implementation of the Hohfeldian fundamental relations between provisions is proposed (Section 5). In Section 6 an example of how this approach can support Hohfeldian inferences for enhancing norm accessibility and reasoning is presented with respect to a European directive case-study. Finally in Section 7 some conclusions are discussed.

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2. SEMANTIC PROFILES OF LEGISLATIVE DOCUMENTS
According to [3] the entire body of laws and regulations may be seen as a set of provisions, carried by speech acts [9], namely sentences endowed with meaning [8]. In this perspective a legislative text can be viewed according to two different profiles:

• a structural or formal profile, representing the traditional legislator habit of organizing legislative texts in chapters, articles, paragraphs, etc.;
• a semantic profile, representing a specific organization of legislative text substantial meaning; a possible organisation of it can be given in terms of normative provisions [3].

Following this perspective, fragments of a legislative text are, at the same time, paragraphs and provisions, according to whether they are seen from a formal or semantic viewpoint.

From a provision-centric view, it is possible to identify three sub-profiles according to which the semantics of a legislative text can be perceived:

• a functional profile representing the organization of the legislative texts structure in terms of provision types, namely a sequence of provisions (as Term definition, Procedure, Duty, Right, Permission, as well as more technical ones as Insertion, Abrogation, Substitution, etc.) and related attributes1 (for example the Bearer of a Duty), reflecting the lawmaker directions;
• a thematic profile representing the organization of the legislative texts structure according to a narrative thread, thus expressing the peculiarities of the regulated field, described by the content of the provision attributes;
• a logic profile representing the relations between provisions (types and attributes) if any, able to describe not only the explicit aspects contained in a legislative text, but also to get implicit ones to emerge.

Provision types and attributes can be considered as a sort of metadata model able to analytically describe fragments of legislative texts, hence the name of Provision Model [3]. For example, the following fragment (article 5, paragraph 1) of the European Directive 2002/65/EC, concerning the distance marketing of consumer financial services:

The supplier shall communicate to the consumer all the contractual terms and conditions and the information referred to in Article 3(1) and Article 4 on paper or on another durable medium available and accessible to the consumer in good time before the consumer is bound by any distance contract or offer.

1also called arguments in [3]
Besides being considered part of the formal profile (a paragraph), can also be viewed as a component of the semantic profile of a legislative text (a provision) and qualified as a Duty, whose attributes are:

- hasBearer: “Supplier”
- hasObject: “Contractual terms and conditions ...”
- hasAction: “Communication”
- hasCounterpart: “Consumer”

Possible relations between provisions can also be identified, like the Hohfeldian fundamental relations [6] between Right/Duty, Liberty/No-right, Power/Liability, Immunity/Disability, as well as relations between provision attributes within the same Hohfeldian framework, as for example the relation between the Duty of a subject (duty Bearer) towards a Counterpart, which can be viewed as an implicit Right of the duty Counterpart towards the duty Bearer.

A provision oriented description of such profiles allows advanced access services to norms, as well as a support to legal reasoning. A typical example can be a service which allows to implement the previously mentioned Hohfeldian reasoning by accessing the rights of a subject, either explicitly expressed or implicitly inferred.

The following sections will show a possible RDF/OWL implementation of the Provision Model, how it can be used to describe legislative texts semantic profiles, as well as a Hohfeldian reasoning scheme on such a model, using an OWL reasoner and SPARQL.

### 3. THE FUNCTIONAL PROFILE

The functional profile of legislative texts can be described in terms of provision types and attributes [3]. In the Provision Model they are organized in two main families: Rules (introducing and defining entities or expressing deontic concepts) and Rules on Rules (different kinds of amendments). Rules are provisions which aim at regulating the reality considered by the including act. Adopting a typical law theory distinction, well expressed by Rawls, they consist in:

- **Constitutive rules**: they introduce or assign a jurisdiction profiles to entities of a regulated reality;
- **Regulative rules**: they discipline actions or the substantial and procedural defaults (remedies).

On the other hand, Rules on Rules can be distinguished in:

- **Content amendments**: they modify literally the content of a norm, or their meaning without literal changes;
- **Temporal amendments**: they modify the times of a norm (come-into-force and efficacy time);
- **Extension amendments**: they extend or reduce the cases on which the norm operates.

A taxonomy of provisions can be represented using RDF/OWL standards. A graphical representation of taxonomy top classes is shown in Fig. 1 (*prv* represents the namespace of the Provision Model).

Provisions top classes are further on specialised: for example *Regulative* provisions can be distinguished into *Rules On Actions* (Right, Duty, Prohibition and Permission) and *Remedies* (Violation, Redress) (Fig. 2). A complete view of provision taxonomy can be found in [3].

![Figure 1: Provision Model top classes.](image)

![Figure 2: Taxonomy of Regulative Provisions.](image)

Each provision type has specific attributes describing roles of entities (for example hasBearer and hasCounterpart are attributes of Duty and Right. For a complete view of provision attributes, the reader can refer to [3].

As discussed in [3], the Provision Model has been conceived as a semantic model able to describe legislative textual fragments, which represent the domain of discourse. Therefore the Provision Model, rather than a theory of normative concepts”, whose domain is the set of entities legal texts talk about, is a metadata model [3], which norms can be considered as result of a legal interpretation of one or more provisions.

### 4. THE THEMATIC PROFILE

The thematic profile, defined as an organization of a legislative text able to communicate, in a narrative fashion, the peculiarities of the regulated fields, can be described by provision attributes contents. They can be expressed by lexical units, or by concepts derived from thesauri/ontologies providing additional information on the entities of the regulated domain [2].

An example of an ontology dealing with the consumer law domain, regulated by national and EU legislations, has been developed within the DALOS project[3][1]. It has been implemented as an extension of the Core Legal Ontology (CLO)[4] developed on top of DOLCE foundational ontology and on the “Descriptions and Situations” (DnS) ontology [7] within the DOLCE+ library[5]. Such an extension aims to cope with the entities of the chosen domain and their legal specificities. In this knowledge architecture the role of a core legal ontology is to provide entities/concepts which belong to the general theory of law, bridging the gap between domain-specific concepts and the abstract categories of formal upper level or foundational ontologies such as, in this case, DOLCE.

Domain-specific concepts are classified according to more general notions, imported from CLO, as LegalRole and LegalSituation. An example of some concepts obtained by the definitions of the consumer law (as CommercialTransaction,

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2 as those of Hohfeld, Rawls, Hart, Ross, Bentham, Kelsen.
3 www.dalosproject.eu
4www.loa-cnr.it/ontologies/CLO/CoreLegal.owl
5DOLCE+ library, http://dolce.semanticweb.org
Consumer, Supplier, etc.) playing specific roles ([7]) is given in Fig. 3.

Figure 3: Excerpt of the DALOS domain ontology.

5. THE LOGIC PROFILE

The logic profile of a legislative text is represented by the set of relations between provisions types and attributes. In this study Hohfeldian relations between provisions have been added as axioms to the RDF/OWL implementation of the Provision Model. Let’s consider the Hohfeldian relation between Duty and Right as an example to show our approach. In terms of Provision Model, a duty of A towards B can be expressed as follows:

\[ \text{Duty}(\text{hasBearer}=A', \text{hasCounterpart}=B') \]

which corresponds to

\[ \text{Right}(\text{hasBearer}=B', \text{hasCounterpart}=A') \]

and vice-versa.

For example article 5 paragraph 1 of the European Directive 2002/65/EC reported in Section 2, can be considered a provision of type Duty involving ‘Supplier’ and ‘Consumer’, so that:

\[ \text{Duty}(\text{hasBearer}='\text{Supplier}', \text{hasCounterpart}='\text{Consumer}') \]

which corresponds to

\[ \text{Right}(\text{hasBearer}='\text{Consumer}', \text{hasCounterpart}='\text{Supplier}') \]

This Hohfeldian relation underlines an equivalence between Duty and Right, as long as the values of the duty and counterpart are swapped, assuming symmetric roles in the Right provision, therefore involving equivalence relations between provision types and attributes.

However, establishing the equivalence relations Duty = Right [3] and hasBearer = hasCounterpart would imply equivalence relations between any duties and rights, irrespective to the argument types and values, as well as between all the provision types sharing equivalence relations between such attributes, which might be inconsistent.

5.1 Extension of the Provision Model

To avoid these problems, while relying on Description Logic expressivity as implemented in OWL-DL, an extension of the Provision Model is proposed.

Firstly an extension able to specify provision attributes according to the related provision types can be implemented. Therefore hasBearer and hasCounterpart relations are distinguished in terms of hasDutyBearer and hasDutyCounterpart as properties of Duty, and hasRightBearer and hasRightCounterpart as properties of Right. The RDF/OWL syntax of the previous relations, limited to Duty (the same holds for Right), results as follows:

```xml
<owl:ObjectProperty rdf:about="hasDutyBearer"/>
<rdfs:domain rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="hasDutyCounterpart"/>
<rdfs:domain rdf:resource="Duty"/>
</owl:ObjectProperty>
```

The specified Duty and Right attributes are shown in Fig. 4.

Figure 4: Attributes of Duty and Right provisions.

A model extension can also be provided by observing that a Right, in Hohfeldian correspondence with a Duty, is actually not explicitly expressed in the text, but represents an implicit provision, basically a different view of the Duty itself, where the values of the attributes are swapped. Therefore the Provision Model can be extended by Duty and Right implicit and explicit subclasses whose RDF/OWL implementation is here below reported:

```xml
<owl:Class rdf:about="ImplicitDuty">
    <rdfs:subClassOf rdf:resource="Duty"/>
</owl:Class>
<owl:Class rdf:about="ExplicitDuty">
    <rdfs:subClassOf rdf:resource="Duty"/>
</owl:Class>
<owl:Class rdf:about="ImplicitRight">
    <rdfs:subClassOf rdf:resource="Right"/>
</owl:Class>
<owl:Class rdf:about="ExplicitRight">
    <rdfs:subClassOf rdf:resource="Right"/>
</owl:Class>
```

Attributes can also be specified as regards both implicit and explicit provisions, so that hasImplicitDutyBearer and hasExplicitDutyBearer are sub-properties of hasDutyBearer, as well as hasImplicitRightBearer and hasExplicitRightBearer are sub-properties of hasRightBearer. The RDF/OWL implementation of the previous relations, limited to the Duty provision type and the hasDutyBearer attribute, is below reported (similar implementation holds for Right).

```xml
<owl:ObjectProperty rdf:about="hasImplicitDutyBearer"/>
<rdfs:subPropertyOf rdf:resource="Duty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="hasExplicitDutyBearer"/>
<rdfs:subPropertyOf rdf:resource="Duty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="hasImplicitRightBearer"/>
<rdfs:subPropertyOf rdf:resource="Right"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="hasExplicitRightBearer"/>
<rdfs:subPropertyOf rdf:resource="Right"/>
</owl:ObjectProperty>
```

Note that only explicit provision types and attributes will be used to describe (mark-up) textual provisions, as they are the only provisions actually (explicitly) expressed in legislative texts, while implicit provision types will be used for legal reasoning.
5.2 Hohfeldian relations in the Provision Model

To define the fundamental Hohfeldian relation between 

Duty and Right, firstly an equivalence relation between explicit and implicit aspects of them is established, in particular ImplicitRight ≡ ExplicitDuty and ImplicitDuty ≡ ExplicitRight. Using OWL-DL the previous relations result:

\[
\text{<owl:Class rdf:about="ImplicitRight"/>} \\
\text{<owl:equivalentClass/>} \\
\text{<owl:Class rdf:about="ExplicitDuty"/>} \\
\text{<owl:equivalentClass/>} \\
\text{<owl:Class rdf:about="ExplicitRight"/>}
\]

In Fig. 5 the established sub-class (Section 5.1) and equivalence relations (Section 5.2) between Duty and Right in their explicit and implicit views are summed up.

![Figure 5: Sub-class and asserted equivalence relations between Duty and Right provisions.](image)

Moreover, equivalence relations between implicit/explicit Duty and Right attributes can be established and represented in OWL-DL as object properties as follows:

\[
\text{<rdf:ObjectProperty rdf:about="hasImplicitRightCounterpart"/>} \\
\text{<owl:equivalentProperty rdf:resource="hasExplicitRightBearer"/>} \\
\text{<owl:equivalentProperty rdf:resource="hasExplicitDutyBearer"/>} \\
\text{<owl:equivalentProperty rdf:resource="hasExplicitDutyCounterpart"/>} \\
\text{<owl:equivalentProperty rdf:resource="hasExplicitRightCounterpart"/>}
\]

In Fig. 6 the asserted sub-property (Section 5.1) and equivalence relations (Section 5.2) between hasDutyBearer and hasRightCounterpart in their explicit and implicit views are summed up. The reader can imagine a symmetric view for the relations between a right bearer and a duty counterpart in their explicit and implicit views.

![Figure 6: Asserted sub-property and equivalence relations between hasDutyBearer and hasRightCounterpart in their explicit and implicit views.](image)

6. HOHFEldIAN INFERENCE CASE-STUDY

In this section an example of how this approach can be used for a norms access system able to support Hohfeldian reasoning is shown.

6.1 Semantic annotation


```xml
<article id="art5">
  <paragraph id="art5-par1">1. The supplier shall communicate to the consumer all the contractual terms and conditions and the information referred to in Article 3(1) and Article 4 [...]</paragraph>
  <paragraph id="art5-par2">2. The supplier shall fulfil his obligation under paragraph 1 immediately after the conclusion of the contract, if the contract has been concluded at the consumer’s request using a means of distance communication which does not enable providing the contractual terms [...]</paragraph>
  <paragraph id="art5-par3">3. At any time during the contractual relationship the consumer is entitled, at his request, to receive the contractual terms and conditions on paper. [...]</paragraph>
</article>

<article id="art6">
  <paragraph id="art6-par1">1. The Member States shall ensure that the consumer shall have a period of 14 calendar days to withdraw from the contract without penalty and without giving any reason [...]</paragraph>
</article>
```

According to the Provision Model and the DALOS ontology, the semantic of such fragments, identified by a document URI and specific IDs, can be summed up as in Tab. 1 (this semantic description is limited to the elements useful to demonstrate the approach, therefore conditions, actions and other involved elements are not described, while provision attributes values are reported as strings).

<table>
<thead>
<tr>
<th>Partition ID</th>
<th>Provision Type</th>
<th>Provision Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>art5-par1</td>
<td>ExplicitDuty</td>
<td>hasExplicitDutyBearer = Supplier</td>
</tr>
<tr>
<td>art5-par2</td>
<td>Procedure</td>
<td>hasProcedureAddresser = Supplier</td>
</tr>
<tr>
<td>art5-par3</td>
<td>ExplicitRight</td>
<td>hasExplicitRightBearer = Supplier</td>
</tr>
<tr>
<td>art6-par1</td>
<td>ExplicitDuty</td>
<td>hasExplicitDutyBearer = MemberStates</td>
</tr>
</tbody>
</table>

Table 1: Semantics of Directive 2002/65/EC excerpt

Having defined the following namespaces

```xml
xmlns:prv="http://www.ittig.cnr.it/ProvisionModel/1.0#" xmlns:cl="http://www.ittig.cnr.it/ontologies/consumer-law/1.0#"
```

for Provision Model and DALOS consumer law domain ontology, respectively, an RDF/OWL semantic annotation of such fragments, can be the following:

```xml
<rdf:Description rdf:about="[URI]#art5-par1"/>
<prv:hasExplicitDutyBearer rdf:resource="[URI]#Supplier"/>
<prv:hasExplicitDutyCounterpart rdf:resource="[URI]#Consumer"/>
```

```xml
<rdf:Description rdf:about="[URI]#art5-par2"/>
<prv:hasExplicitDutyBearer rdf:resource="[URI]#Consumer"/>
<prv:hasExplicitDutyCounterpart rdf:resource="[URI]#Supplier"/>
```
Duties which will provide the explicit expressed in the text. The query will be:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX cl: <http://www.ittig.cnr.it/ontologies/consumer-law/1.0#>
PREFIX prv: <http://www.ittig.cnr.it/ProvisionModel/1.0#>

SELECT ?par WHERE { ?par prv:hasImplicitRightBearer cl:Consumer }
```

The distinction between implicit and explicit provisions and attributes allows also to select, for example, among all the Rights of aBearer, only those which are not explicitly expressed in the text. The query will be:

```
SELECT ?par WHERE { ?par prv:hasImplicitRightBearer cl:Consumer }
```

### Table 2: Virtual expansion of the SPARQL query in Fig. 7, through inference on Provision Model.

<table>
<thead>
<tr>
<th>Virtual query expansion</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>?par prv:hasExplicitRightBearer cl:Consumer</td>
<td>art5-par3</td>
</tr>
<tr>
<td>?par prv:hasImplicitRightBearer</td>
<td>art5-par1</td>
</tr>
<tr>
<td>cl:MemberStates</td>
<td>art6-par1</td>
</tr>
</tbody>
</table>

#### 6.2 The inferred model

An RDF/OWL provisions management system can be given inference facilities by an OWL reasoner able to derived an inferred Provision Model. In this case-study the Pellet Java based OWL-DL reasoner has been used. The result is a model where inferences are calculated from Provision Model axioms.

#### 6.3 Querying the system

A provisions repository can be queried to retrieve specific type of provisions, involving specific entities, using for example SPARQL. A SPARQL query able to retrieve the rights of Consumer is shown in Fig. 7, where ?par is the variable which will contain the identifier of the retrieved provision instances (usually paragraphs in a legislative document).

The query will be:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX prv: <http://www.ittig.cnr.it/ProvisionModel/1.0#>
PREFIX cl: <http://www.ittig.cnr.it/ontologies/consumer-law/1.0#>
SELECT ?par
WHERE { ?par prv:hasRightBearer cl:Consumer }
```

#### 7. CONCLUSIONS

An approach to the Semantic Web in the legal domain through the Provision Model and domain ontologies, as well as an implementation of the Hohfeldian fundamental relations between provisions, have been proposed. To obtain this, the Provision Model has been extended to represent provisions types and attributes, either implicitly or explicitly expressed. An example showing how this approach can support Hohfeldian inferences has also been described. The approach is implemented by OWL-DL expressivity, thus benefiting from its computational tractability. The possibility to represent other legal relations using this approach is expected to be investigated in a future work.

### 8. REFERENCES