e-government: A Legislative Ontology for the '*SIAP*' Parliamentary Management System

Carmen Costilla[1], Juan P. Palacios[2], José Cremades[3] and Jorge Vila[2]

[1] Titular Professor, *Information Systems and Databases* (SINBAD) Research Group
Technical University of Madrid (UPM)
www.sinbad.dit.upm.es, costilla@dit.upm.es

[2] Ph. Researchers at the SINBAD-UPM
www.sinbad.dit.upm.es, {jppalacios, jvila}@sinbad.dit.upm.es

[3] Founder Partner of CRC Information Technologies
www.crcit.es, jcremades@crcit.es

Abstract. The requirement of integrating, sharing and reusing legislative information is a research issue gaining priority for governments and institutions. The legal world is complex, heterogeneous and wide in scope. Therefore, we find convenient to define ontologies as a tool to decrease this complexity inherent to the legal domain. This paper is based on the *Parliamentary Integrated Management System* (*SIAP*) built for the *Asamblea of Madrid* and that is successfully running since 1999. In this context, we describe how *SIAP* manages the *Legislative Initiative (LI)* that arrives to a Parliament. Later, we propose an ontology in order to describe the *LI*, called *Legislative Ontology (LO)*. This *LO* conceptually models the *LI* including the structure of the Emendations to this *LI* and is connected with the act of making and passing laws. So, this *LO* makes easier the organizing task in the *LI* and, in general, all the Legislative procedural steps. Besides, this ontology could be offered as a basis for other parliamentary systems (as *SIAP*) to improve their *LI* procedures.

1 Introduction and Motivation

Nowadays, the legislative world is an important research goal. The requirement of integrating, sharing and reusing legislative information is a research issue gaining priority for governments and institutions. The *Asamblea of Madrid* is a clear example of governmental institution that had experienced this necessity. Currently, all documentary fonds of the parliament of Madrid are digitized, integrated and managed by the Parliamentary Integrated Management System (*SIAP*). *SIAP* was funded by the *Asamblea de Madrid* (1997-2000) and was built at our SINBAD-UPM research group joint to the Spanish businesses *CRC Information Technologies (CRC IT)*. Nowadays, CRC IT commercializes *SIAP* (www.crcit.es/SIAP) and it is sponsored by the Technical University of Madrid (UPM), Oracle and Cronos entreprises.

As we know, the legislature is the democratically elected group of people who have the power to make and change laws. And the Legislative Ontology *LO* (proposed here) is connected with the act of making and passing laws.

Any Parliament has a double purpose. It makes possible to control the executive (the government) that has power over a concise society (country, autonomy, etc.). Also, it promotes laws as the legislative power basement.

This double aim is obtained through the Parliamentary Initiatives. One kind of Parliamentary Initiative is the *Legislative Initiative* (here after, *LI*). There are two kinds of *LI*: Law Project (LP), coming from the government's political party; and Law Proposition (LPROP), coming from another party. The main goal of any *LI* is the promulgation of the Law.

SIAP is successfully running at the *Asamblea de Madrid* since 1999. *SIAP* is composed of several modules and applications. It controls the documentary workflow in a Parliament and integrates and automates most of the parliamentary activity.

The *LI* automatic organization is an important application of *SIAP*. Its main objective is the automation of all *LI* procedural steps. That means, it includes all phases of parliamentary work, since the *LI* arrives at the Parliament until the Law is promulgated.

The *LI* procedural steps could be large and complex, even though they are perfectly regulated by the "Normative" of any Parliament [1]. Usually, the procedures of the *LI* carries out through the following stages:

- The *LI* (as document) is registered at the Parliament and arrives at the Parliamentary Table. This Table accepts its procedure and orders its publication on the Parliamentary Official Bulletin.
- The Parliamentary Groups register the emendations to the *LI* (in a fixed period). The emendations to the text of the *LI* could be total or partial.
- In general, the most important procedures of the *LI* start with the emendations and the *LI* text. Both are discussed and voted in the corresponding Committee. These actions produce an alternative text, merging the approved emendations.
- Finally, this new *LI* text is voted and approved by the plenary, in charge of the Law promulgation.

It is interesting to remark that this *LI* workflow, here summarized, could be applied to any Parliament. In the same way, the *LI*'s own organization (later described) also results very similar in any Parliament.

But the intrinsic richness of the legislative language implies that each *LI* is very complex in its content, with its own and specific structure, and with different workflow procedures. For example, the *LI* objective and the number and type of the *LI* emendations are completely different from other previous ones (even during the same legislature).

This heterogeneity makes difficult the exchange of information among different parliaments. Besides, the guarantee of consistency and integrity of the *LI* content in the actual legal framework is also a hard task. This problem becomes sharpen when the goal is the integration and the reusability of the legislative information that each Parliament admits, performs, promulgates and publishes, including its relations with other parliaments.

Fig. 1. SIAP is running at the Asamblea of Madrid

Apart from it, the semantic web provides ontologies describing a shared knowledge about a specific domain [7]. The ontologies allow to explicitly define structures and contents, coding the implicit rules of a part of reality. These explicit declarations are independent of its goal or its target domain [16]. Each ontology tries to get a consensus in a common understanding to reuse and share it between applications. In this sense, we adopt the ontology as a paradigm to reduce the complexity inherent to the legal domain (semantics reduces complexity).

As previous works, we have developed two ontologies based on two international archival description standards: ISAD(G) [19] and ISAAR(CPF) [18]. In addition, thanks to the gained experience of *SIAP*, we have also developed a Parliamentary Digital Archive ontology, called SIAP-O [14], intended to describe the structure of a Parliamentary Digital Archive (from the one working in Madrid). Based on these three ontologies, we have proposed a web architecture [13] for the virtual and dynamic integration of several Digital Archives [12], with mediator and wrapper layers.

This paper describes how *SIAP* deals with the *LI* procedural steps and proposes a Legislative Ontology, *LO*, (mainly its taxonomy) in order to describe the *LI* organization. Also, this *LO* includes the structure of the Emendations to the *LI*. The final idea is incorporating this ontology to the *SIAP* module in charge of the *LI* management. The *LO* ontology could be the basis for the improvement of other parliamentary legislative information systems similar to *SIAP*.

The remainder of this paper is organized as follows: Section 2 deals with the *SIAP* Integrated Parliamentary Information System, Section 3 describes the proposed legislative ontology. Finally, in Section 4, the conclusions are given.

2 The Parliamentary Integrated Management System - SIAP

Thanks to *SIAP* (Integrated Parliamentary Management System) the *Asamblea of Madrid* has totally digitized its documentary fonds, since the beginning of our democracy. The *SIAP* management system is powerful and ideally advanced for the web. The Legislative Management System is running at the *Asamblea de Madrid* as an application included in the broader *SIAP* system.

SIAP manages and controls the workflow of overall parliamentary documentary information and automatically creates the many types of parliamentary document produced by political activity. The *SIAP*'s design main guidelines were: the proper political activity, the institutional normative, Political Initiative typology and the nature of political documentation. In order to provide *useful information*, as intelligent as possible, we follow the guidelines in [4], [24] and other developed previous systems [8], [9].

The *SIAP* system structures the Political Initiative and Parliamentary jobs (Plenary sessions, Committees, etc.). The *SIAP* workflow sends the document to be considered (established by the regulation) according to each type of political initiative. Moreover, it is controlled when a document is sent to be published into the Official Bulletin, the Sessions Journal and dynamic web pages automatically created for a specific user type. *SIAP* associates the document to the respective File, to the corresponding Daily Agenda, to the pertinent Official Bulletin, to the previous scripted political sessions,

etc. Besides, *SIAP* also knows where the original document is stored and where the multiple document copies are held.

2.1 Objectives and Architecture

SIAP models Parliament's overall structure and organization. It has demonstrated a high degree of security and effectiveness for those procedural steps in each political initiative type. The main goal of *SIAP* is to obtain a perfect integration of the parliamentary information with the proper activity of the Parliament.

SIAP controls input documents and produces a huge amount of output documents, some of them with a public nature. It makes the entire Parliament of Madrid Official Bulletin, and the greatest part of Sessions Journal. Besides, *SIAP* applies documentary searching to other external Official Bulletins (from foreign institutions). If it were convenient, all this information would be dynamically published on the web.

- *Management of information generated by political Institution' activity,*
- *Control of regulated workflow,*
- *Design and implementation of Parliament structure and organization and its perfect integration into the parliamentary documentary flow,*
- *Semantic control, applications and GUIs software.*

SIAP has an open architecture to be implemented into the Institution network. It has an underlying object-relational database running into the Database Server and its applications could also work on its own (Law Budget Project, Archive Management, Registers, Documentary information due to the daily political activity, etc.).

SIAP runs on Oracle in Client/Server (C/S, two tiers) and in Internet/Intranet (three or four web tiers). In C/S, for providing services to civil servants that update the information system (with a high degree of protection and security). In C/S, protocols SQL*Net8 and OCA and, in Web OAS (Oracle Application Server and IAS of Oracle 9i) are used. For both, IntermediaText for information retrieval (before Oracle Context) is used. Figure 2 represents the documentary workflow and *SIAP* open architecture; where BOAM means Asamblea of Madrid Official Bulletin and DDSS means Sessions Journal.

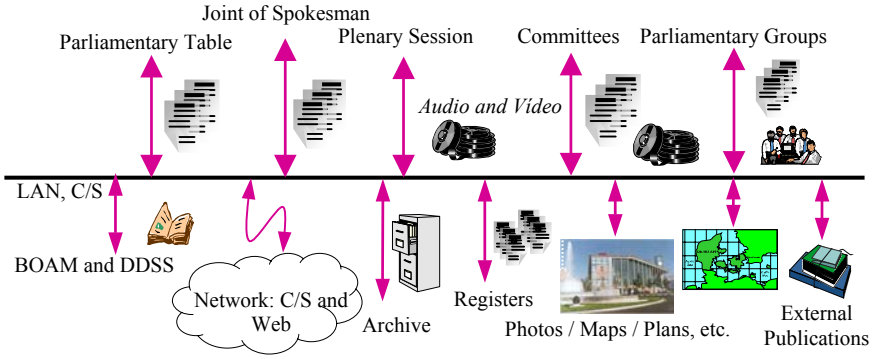

Figure 2. Documentary workflow and ***SIAP*** open architecture (C/S and Web)

2.2 Capabilities

The daily activity in a Parliament produces documents tailored to many specific type of Parliamentary Initiatives. *SIAP* holds especially relevant information organized in *files* (descriptive folders) according to the initiative typology and objective. The *file* collects related information on political activity and marks the procedure type to schedule with all documents that are held inside it (initiatives, photographs, maps, graphics, audio, video, etc.).

Additionally, the file incorporates the following descriptive information: *Identification*, *Censure or judgment of the contained documents*, *Schedule*, *File Classification and its respective documents*, *Allocation*: topographical, informatics and address of Institution, departments, dependencies, etc., *File prosecution* (w*orkflow* with all states that must or should be adopted by the file, *Current status* and *History)* and, finally, *Relationships* between files by subject, type, date, state, descriptors, etc.

SIAP handles queries against the underlying object-relational database (SQL) and/or to the thesaurus with a powerful *information retrieval*. It searches thousands of publications and locates the subject of interest in a few seconds; locates the annexed document to the file in an almost instantaneous response, independently of the Legislature where it is stored [2]; and, finally, creates a lot of report results [10] (www.asambleamadrid.org).

SIAP controls the all of the information from any Legislature, knowing the topographical key signatures of its complete archive fonds. For example, The Madrilenian Court can instantaneously locate all files and documents dealing with *anorexia,* since the beginning of the Spanish democracy and can reproduce video fragments of the political sessions (Plenary and Commissions) in which this illness was discussed.

Fig. 3. The SIAP Parliamentary Activity Management at the Asamblea of Madrid

Through web applications, the parliament can negotiate the information exchange between similar institutions at any level, in an integrated and intelligent way. *SIAP* can offer *global information* produced by many others Institutions, as well as its own [15], [21], [22].

SIAP was introduced in many Spanish Parliamentary and Political Parties Conferences (since 1999), and it is considered a powerful and complete system. Figure 3 shows one of its main screen concerning to the Parliamentary Activity Management, through which the *LI* is automatically processed.

If other institutions could have similar information systems, then the web e-government information capabilities will grow in a spectacular way. We want to remark on how easy is to get dynamic interoperability on the web when data sources have the same Information System (same design and semantic control, similar software, etc.), as figure 4 represents. However, in heterogeneous

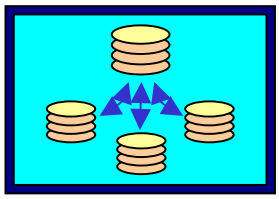

Fig. 4. Web Multi-parliamentary

Information Systems environments it could be hard to provide easy and powerful access to a global e-government information.

2.3 Parliamentary Legislative Initiative

SIAP is organized in ten modules that can run in an integrated or independent way. These modules make use of four auxiliary applications. One of these applications is in charge of the *Legislative Initiative Organization (LIO)* we are dealing with.

Fig. 5. The Budget Law Project Application of SIAP at the Asamblea of Madrid

The *LI* text (Law Proposition or Law Project) is organized in levels (Titles, Chapters, Sections, Articles, etc.). The *LIO* application allows to load the *LI* text from a file, organizes and publishes it. This organization could be applied manually (pointing out the content of Title I, art. 1, art 2., etc.) or automatically.

Once the *LI* arrives to the Parliament, the *LIO* application can publish it on the Official Bulletin automatically. In order to do it, you only need to specify the format at any different level being present in the text of the *LI* (for example, the titles are in single line, capitalized and with roman numeration) and pushing a button to get it.

Figure 6 shows the hierarchical organization of the *LI.* These are optional levels (some of them can be empty), but the part bounded to the articled must be filled. So, *SIAP* organizes the *LI* in this way.

In order to publish the *LI* on the Official Bulletin, *SIAP* applies the format layout used at the Parliament.

SIAP manages the *LI* until the law is promulgated. It monitors all its procedures in the related Committee, in the Plenary Session

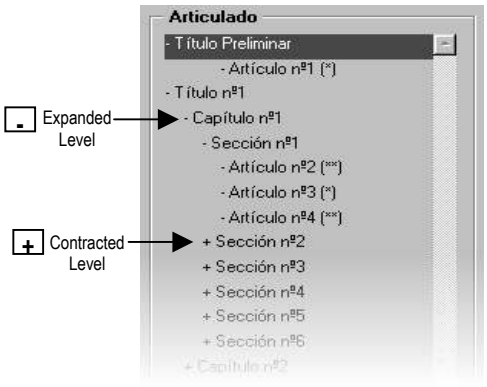

Figure 7. Articled tree structure

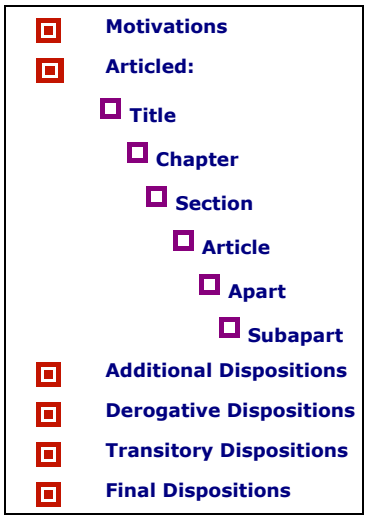

Fig. 6. *LI* Hierarchical Organization Levels

and produces many reports from the parliamentary activities related to this initiative.

This hierarchical organization is composed by syntactic elements on a tree, managed as directories. This syntactic layout of the *LI* elements helps for the automation and integration tasks of the legislative structures. So, if you are located on a parent level, its lower levels can be expanded (to be shown) or contracted (to be hidden), as figure 7 represents.

2.4 Legislative Emendations

Once a *LI* is published on the Official Bulletin, the parliamentary groups can register emendations in order to modify total or partially the *LI* text. *SIAP* manages and monitors the emendations. Each emendation registered (as a document) in the Parliament keeps related to the corresponding *LI* hierarchical level. *SIAP associates each emendation with the related level of the LI* and specifies the changes that emendation would produce in the text in case it were approved.

According to the presentation medium, the emendation typology is: *written*, *transaction* or '*in voce*'. And, the typology due to the kind of proposed changes is:

- *Addition* (to add text in some point or a new one).
- *Modification* (to modify all or part of the text in a point, or to modify a point and all its related sublevels. For instance, modifying an article and creating new sections inside it).
- *Deletion* (to delete parts of the text in a point or all the point, including all sublevels).

The emendation is linked to the *LI* text in different ways: a) several emendations are related to one point inside one *LI* level; b) one emendation can reference several parts of the text inside a point; c) one emendation can reference many points of the articled.

The *relationship between the emendation and the articled* is shown in a visual and intuitive way. Next to each *LI* point it is indicated the number of emendations linked. So, in figure 7, each asterisk '*' in one point, indicates that there is an emendation related to that point. From a menu at each level, we can get details about these emendations, and, in case you have the due grants, these emendations can be modified.

There are two *LI* reports involved in its procedural steps.

- *The publication of the LI in the Official Bulletin (OB)*, provides a homogeneous format to the *LI* text, as the Parliament's style specifies.
- *The two columns notebook*, intended to support the works carried out in the Committee. The left

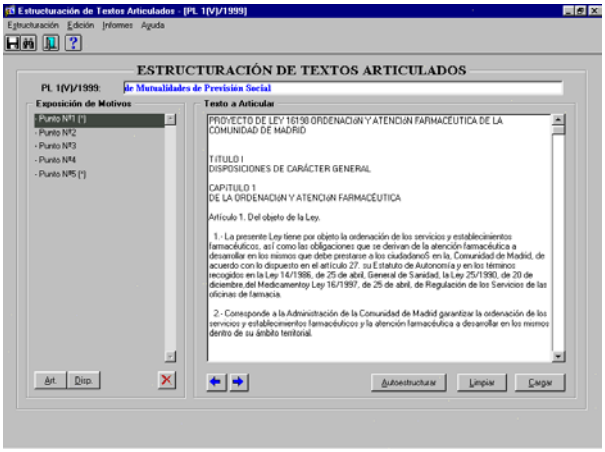

Figure 8. The main screen of the LI organization of *SIAP*

column contains the initial *LI* text, and the right one shows the emendations. In such way that, for each point referenced by the emendations, it is indicated: author, type and text of each emendation.

This application stores the *original LI text* and supports the rest of the legislative modules (Committee and Plenary Sessions, etc.) Besides, at any moment, the *LI evolution* can be queried showing the *status* in which the emendations are up to date (approved, rejected or cancelled), and how they have affected the *LI* text. This way, *SIAP* manages the historical *LI* evolution.

Figure 8 shows the main screen of the *LI* management. It is divided in three frames. The upper one contains the identification data and the tittle into the text box. The left one shows the points of the *LI* organization (Motivation, Articled and Dispositions). The right frame shows the original *LI* text.

Once the emendation period is over, the *two columns notebook* is created and the Committee can start working on it.

We want to remark that *SIAP* automatically creates this *two columns notebook* report from the syntactic links between the *LI* text and the emendations. That means, the system is able to include, modify and remove elements inside a *LI* from the emendations.

Nevertheless, as the system lacks of semantics, it cannot 'understand' the changes it makes. Thus, it is impossible to automatically detect inconsistencies or integrity lacks inside the *LI* text. In fact, nowadays, the lawyer is the person in charge of assuring this kind of semantics among the original *LI* text and all the approved emendations.

As a consequence of this, we propose to build an ontology that monitors the semantics of the resulting *LI* text. After reaching this semantic objective, the next one will be the reusing and sharing of the legal framework produced in one Parliament, and the consistency with the laws promulgated by other democratic parliaments.

3 The SIAP Legislative Ontology

According to [23], the semantic conceptual models of legal domain are fundamental for the e-Government success. The incorporation of semantics in the legal structures could be very powerful.

This way, the computers will find the meaning of data following the *links* to the definitions of the terms and its key rules. It makes easier the automatic design of legislative services; because the main bottleneck is the inherent heterogeneity of the legal structure contents. To solve this problem and to be able to code the necessary information, we have XML and OWL ontologies as the best options [16].

We need to build ontologies [23] because the legal domain is not simple and it needs to be used for a wide audience.

An ontology describes shared knowledge on a specific domain in order to establish a communication way between humans and programs [2], [7]. Each ontology provides a precise definition of the terms (concepts) of a specific domain; that is, it provides a common language for sharing and re-using knowledge of some phenomenon in the domain of interest [16], [25] between applications and groups.

Consequently, applications can speak to each other and interpret, without ambiguity, the information they exchange. For this reason, they have been accepted as powerful description tools that allow to make explicit the semantic concepts. Since the early 1990s, a lot of research [3], [5], [6], [17], [25] deals with these semantic problems, where ontologies play a fundamental role.

3.1 An Ontology for the Legislative Initiative

The *LI* procedural steps are slow and complicated, due to the *LI* content complexity and the several emendations. Thus, the automation of the parliamentary work is sometimes inefficient and difficult to solve by intelligent information systems. Moreover, it seems to be important establishing a communication channel that allow the interoperability with other parliamentary systems [12]. In this context, there are current researches about web architectures [14].

This paper defines a *Legislative Ontology* (*LO)* in order to share, integrate and reuse parliamentary information, establishing a taxonomy among legislative concepts. Additionally, it makes possible the definition of semantic rules for the knowledge inference mechanisms. These rules are important to make possible interoperability with other different *LI* produced inside or outside the parliament.
Each concept of this *LO* is defined '*per se'* through properties and relationships to other concepts. Above this taxonomy, the knowledge inference mechanisms could be implemented.

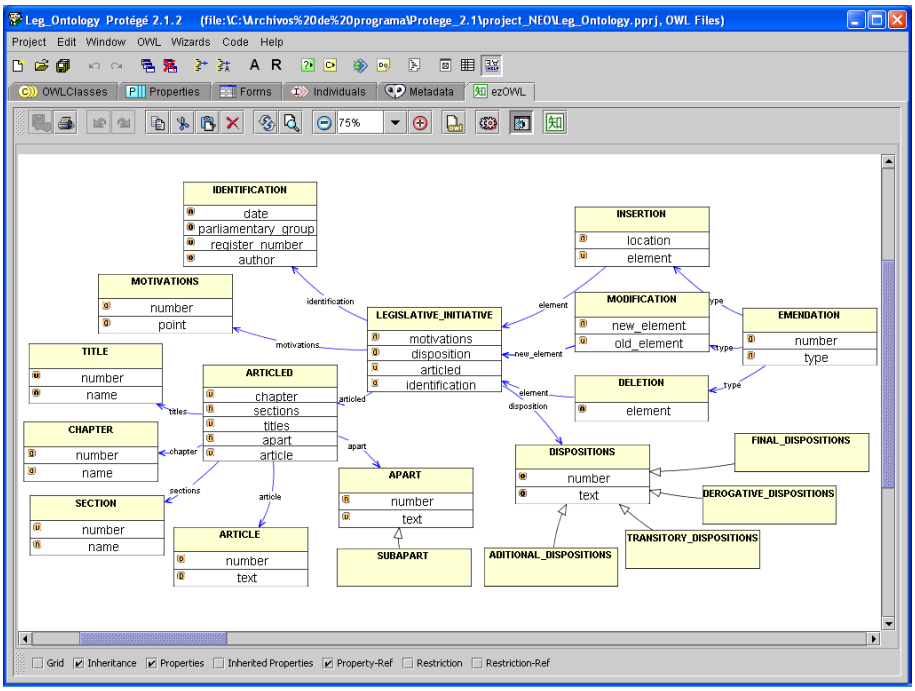

Figure 9. Partial graph of the Legislative Ontology, *LO*

In addition, this kind of ontology enables the conceptual representation of the emendations and the support for the 'intelligent' *LI* procedural steps.

Through this *LO* different parts of the *LI* could be semantically connected. In the future, if many parliaments use this *LO*, it could also be possible the interoperability among many *LI* coming from different parliaments.

If the system understands the meaning of the managed concepts, then it will be able to infer the right actions (insert, update or delete) in order to integrate the emendation into the *LI* text.

```
...
<owl:Class rdf:ID="LEGISLATIVE_INITIATIVE"/>
<owl:ObjectProperty rdf:ID="identificacion">
  <rdfs:domain rdf:resource="# LEGISLATIVE_INITIATIVE"/>
  <rdfs:range rdf:resource="#IDENTIFICATION"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="motivations">
  <rdfs:range rdf:resource="#MOTIVATIONS"/>
  <rdfs:domain rdf:resource="# LEGISLATIVE_INITIATIVE "/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="articled">
  <rdfs:range rdf:resource="#ARTICLED"/>
  <rdfs:domain rdf:resource="# LEGISLATIVE_INITIATIVE"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="dispositions">
  <rdfs:domain rdf:resource="# LEGISLATIVE_INITIATIVE "/>
  <rdfs:range rdf:resource="#DISPOSITIONS"/>
</owl:ObjectProperty>
...
```

Figure 10. Partial definition of the LEGISLATIVE_INITIATIVE concept in the *LO*

SIAP is in charge of materializing (at the lower abstraction level) these changes to the *LI*. However, this *LO* adds intelligence to the *LI* procedural steps and helps to promulgate the Law. Besides, it makes easy to search, extract, represent and interpret the *LI* in a Parliament.

The *LO* definition is based on the flowcharts and in the analysis of the *LI* procedure realized at *SIAP* [11]. Figure 9 shows the partial *LO* OWL graph defined with Protégé 2000.

The *LI* is composed of 17 concepts. The two main ones are LEGISLATIVE_ INITIATIVE and EMENDATION. Figure 10 shows a part of the OWL definition of the LEGISLATIVE_INITIATIVE concept and figure 11 shows the OWL definition of the EMENDATION concept.

```
…
 <owl:Class rdf:ID="EMENDATION">
  <rdfs:subClassOf>
   <owl:Restriction>
    <owl:cardinality
        rdf:datatype="http://www.w3.org/2001/XMLSchema#int">
        </owl:cardinality>
    <owl:onProperty>
     <owl:ObjectProperty rdf:ID="type"/>
    </owl:onProperty>
   </owl:Restriction>
  </rdfs:subClassOf>
 </owl:Class>
…
 <owl:ObjectProperty rdf:about="#type">
  <rdfs:range>
   <owl:Class>
    <owl:unionOf rdf:parseType="Collection">
     <owl:Class rdf:about="#INSERT"/>
     <owl:Class rdf:about="#UPDATE"/>
     <owl:Class rdf:about="#DELETE"/>
    </owl:unionOf>
   </owl:Class>
  </rdfs:range>
  <rdfs:domain rdf:resource="#EMENDATION"/>
 </owl:ObjectProperty>
  …
```

Figure 11. Partial definition of the EMENDATION concept in the *LO*

The LEGISLATIVE_INITIATIVE concept describes the elements included in the *LI*, as:

- '*motivation*'. This concept gives an explanation about the reason why the *LI* is proposed.
- '*articled'*. It contains the hierarchical structure of the *LI*, composed of *Titles, Chapters, Sections, Articles*, etc.
- '*dispositions'*. This concept explains the final information that adds, summarizes and complements the articled part.

Also, it is described the EMENDATION concept, intended to *insert, update* or *delete* some element from the *LI*. Thus, this concept needs to be linked to the concise text point inside the *LI*, which is the updating target. This concept is categorized as follows:

- '#INSERT': adds information to the *LI* text, indicating the location of the new text.
- '#UPDATE': modifies total or partially the original text in a point and all its related sublevels.
- '#DELETE': deletes the text in a point or all the point, including all sublevels.

The *LI* organization that *SIAP* is running since 1999, enables to organize one particular *LI* in a given parliament.

However, *SIAP* does not understand the *LI* as a XML document, neither is able to semantically establish relationships among the conceptual terms defined in one ontology [20]. Therefore, the *Legislative Ontology* here proposed permits the following improvements: adds semantic to the *Legislative Initiative* procedural steps, makes possible the re-using and sharing of these kind of concepts, enables the knowledge inference in *SIAP* and, in the future, it will help to guarantee the integrity and consistency of the legal domain inside a parliament and with other similar ones.

4 Conclusions

We have taken as the starting point the *Parliamentary Integrated Management System* (*SIAP*), successfully running at the Asamblea de Madrid since 1999. *SIAP* makes the legislative organization allowing to work with one *Legislative Initiative* in one parliament. However, *SIAP* does not understand the *Legislative Initiative* as a XML document, neither is able to semantically establish relationships among the conceptual terms defined in one ontology.

This paper proposes a *Legislative Ontology* in order to manage the legislative procedural steps and to support its corresponding emendations inside a parliament.

This *Legislative Ontology* defines an OWL coded taxonomy, made through Protégé2000, to manage the *Legislative Initiative* and Emendations organization. Making use of this semantic tool and the *two columns notebook*, the *Legislative Initiative* and *Emendations* texts are merged to create a new legislative text.

Finally, we come up with some future applications of the *Legislative Ontology* here introduced.

Acknowledgments

This work is partially granted by the Ministry of Science and Technology (MCYT-TIC2002-04050-C02-02, DAWIS-UPM project), by Community of Madrid (07T/0056/2003/3, EDAD-UPM project) and by 'Spanish Network of Excellence Databases', RedBD, (MCYT-TIC2000-3250-E).

References

1. Asamblea Madrid, *Reglamento Asamblea de Madrid*, ISBN:84-451-1260-0, Madrid, 1997.
2. Baeza y Berthier, *Modern Information Retrieval*. Addison Wesley, 1999.
3. Berners-Lee T, Hendler J, Lassila O, *The semantic Web*. Scientific American 284(5): 34-43, May 2001.
4. Bernstein P, Halevy A and Pottinger R, *A Vision of Management of Complex Models.* ACM Sigmod Record, 29(4): 55-63, Dec. 2000.
5. Calvenese D, Giacomo de G and Lenzerini M, *A Framework for Ontology Integration*. In Proc.of the First Semantic Web Working Symposium, pp 303-316 – 2001.
6. Chandrasekaran B, Josepheson J, Benjamins VR, *Ontologies: What are they? Why do we need them?* IEEE Intelligent Systems, 14(1):20-26, 1999.
7. Clyde W, Hossapple, Joshi KD, *A collaborative approach to Ontology design*. Communications of the ACM. Vol. 45 n. 2, pp.42-47, Feb. 2002.
8. Costilla C, Bas MJ, Villamor J, *SIRIO: A Distributed Information System over a Heterogeneous Computer Network*. ACM Sigmod Record, 22(1): 28-34, March 1993.
9. Costilla C, Bas MJ, Villamor J, *The Object Data Model and its Graphical User Interface for an Object Database System*. Proc. Biwit, 161-172, IEEE Computer Society, 1995.
10. Costilla C, Calleja A, Cremades J, *SIAP: Sistema de Información para Ayuntamientos y Parlamentos*, Círculo Usuarios de Oracle, CUORE, Sección *'Vivat Academia'*, Oct. 2003.
11. Costilla C, *Análisis Funcional del Sistema Integrado de Gestión Parlamentaria*, SIAP Technical Report to *Asamblea de Madrid*, 144 pages, April 1999.
12. Costilla C, Palacios JP, Rodríguez MJ, Cremades J, Calleja A, Fernández R and Vila J, *Semantic Web Digital Archive Integration*, Int. Workshop on *Web Semantics*, 14th Int. Conf. on *Database and Expert Systems Applications*, DEXA 2004, IEEE Computer Society, ISBN: 0-7695-2195-9, pp. 179-185, Zaragoza, Spain, August, 2004.
13. Costilla C, Palacios JP, Rodríguez MJ, Fernández R, Cremades J and Calleja A, *Web Digital Archives Integrated Architecture*, in The 5th Int. Conf. on *Internet Computing* (IC'2004), Vol 1, Session: *Web Mining*, Arabnia H and Droegehorn O (eds.), ISBN: 1932415-44-0, CSREA 2004, pp.128-134, Las Vegas, USA, June, 2004.
14. Costilla C, Rodríguez M, Palacios J, Cremades J, Calleja A and Fernández R, *A Contribution to Web Digital Archive Integration from the Parliamentary Management System 'SIAP'*, Proc. of Sixth Int. Baltic Conf. on *Data Bases and Information Systems*, Barzdins J (ed.), ISBN:9984-770-11-7, pp. 481-496, Riga, Latvia, June, 2004.
15. Florescu D, Levy A and Medelzon A, *Database Techniques for the World Wide Web: A Survey*. ACM Sigmod Record, Sept. 1998.
16. Gruber, T. R. *Towards principles for the design of ontologies used for knowledge sharing*. Int. Workshop on Formal Ontology, 1993.
17. Guarino N and Welty Ch., *Evaluating Ontological Decision with ONTOCLEAN*. Communications of the ACM. Vol. 45 n. 2, pp. 42-47, Feb. 2002.
18. *International Standard Archival Authority Record for Corporate Bodies, Persons and Families,* 2nd edition, International Council on Archives , ISBN: 2-9521932-2-3, 2004.
19. *ISAD(G) General International Standardization Archival Description*, 2nd edition, ISBN 0-9696035-5-X, International Council on Archives, Ottawa 2000.
20. Kim, H. *Predicting how ontologies for the semantic web will evolve*. Communications of the ACM. 45(2): 47-51, Feb. 2002.
21. Mendelzon A, Mihaila G and Milo T, *Querying the World Wide Web*. JODL, (1,1) 1997.
22. Özsu MT, Valduriez P, *Principles of Distributed Database Systems*, Prentice-Hall, 1999.
23. Traunmuller R, *Legal Modelling as Part of Knowledge Enhanced e-Government*, in Proc. Of ICAIL03, Workshop on E-Government, Edinburgh, UK, June 2003.
24. Wand Y, Storey VC and Weber R, *An Ontological Analysis of the Relationship Construct in Conceptual Modelling*. ACM Transac. on Database Systems, 24(4):494-528, Dec 1999.
25. Zhong N, Liu J, Yao Y (eds.), *Web Intelligence*, Springer Verlag, 2003