Towards Jordan e-laws ontology

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ABSTRACT

Ontology has its roots in philosophy which has been defined as a particular theory about the nature of being or the kinds of existence. Laws consist of rules that regulate the conduct of individuals, businesses, and other organizations within society. It is intended to protect persons and their property from unwanted interference from others. It has been found that the ontology provides adequate means to represent different legal domains. By using concepts and structures that come natural to lawyers (norms, acts and concepts), models based on the ontology can be easily understood; the demand of clarity is met. An experiment has been conducted to extract concepts for e-law ontology application. Text-mining tools have been used to extract concepts in the domain of e-commerce laws. This paper is using the REACH's framework, which is a core group of members of the IT industry, for e-commerce laws results and some law cases related to E-commerce. Four cases have been selected. All these resources have been converted to text format. This paper reflects on the results of this experiment.

Keywords: Ontology, e-Laws, Semantic web, E-Commerce, Text-Mining.

1. Introduction

The term "ontology" has its roots in philosophy which has been defined as a particular theory about the nature of being or the kinds of existence [13]. In the computer science community, ontology becomes an important issue. Many research areas study ontology, fields such as Artificial Intelligence (AI), knowledge-based systems, language engineering, multi-database systems, agent-based systems, information systems, etc [7].

Uschold et al. argue that ontology may take a variety of forms, but necessarily it will include a vocabulary of terms, and some specifications of their meaning. This includes definitions and an indication of how concepts are inter-related which collectively impose a structure on the domain and constrain the possible interpretations of terms [17].

Ontology is required to describe the semantics of concepts and properties used in web documents. E-laws ontology has been built using existing resources. It has been shown that extracting concepts is less hard than building relationships among them. A new algorithm is needed to reduce the number of relationships, so the domain knowledge expert (i.e. lawyer) can refine these relationships.

This paper has been organized as follows: section two gives a background and motivation for building e-laws ontology. Section three explains the ontology life cycle. Section four identifies the main steps in building an e-laws ontology. Section five concludes the paper.

2. Background: Law and ontology

There are many cases were the intersection of the law and cyberspace gets more evident.

For example, in the music world copyright laws have long protected owners of intellectual property. The expanding use of the Internet and file-compression technology makes it hard to protect both the band and the owner [14]. In the last decades, using computer assisted legal systems has received more attention with the development of computer technology. There still is a need to solve many problems in the legal domain such as legal modeling, representing rules and cases, interactions, as well as solving semantic issues. Some new systems are trying to solve these issues. For example, the computer assisted legal systems for Bermer (See, for example, the H. Bermer at. www.innoventures.nl.).

With the advent of the semantic Web, many e-commerce applications are starting to use ontology in order to solve many semantic problems. It has been argued that beyond software engineering and process engineering, ontological engineering is the third capability needed if successful e-commerce is to be realized.

Laws consist of rules that regulate the conduct of individuals, businesses, and other organizations within society. It is intended to protect persons and their property from unwanted interference from others. The law forbids persons from engaging in certain undesirable activities [3]. Ontology has been used by many researchers in many law-applications. Bruker et al. [2] use it in artificial legal-reasoning. They proposed a number of primitive functions of legal sources and legal knowledge. Boer et al. used ontology for comparing and harmonizing legislation in the European Union [1]. The Information Society of Technology (IST) group used ontology in their e-court system to organize their databases http://www.cordis.lu/ist/ka1/administrations/home.html$.

Mommers uses legal ontology in collaborative workspace applications [15].

2.1 The motivation

Building e-government applications faces the problem of e-commerce laws. This paper builds a standard for e-commerce laws. It has been found that the ontology provides adequate means to represent different legal domains. By using concepts and structures that come natural to lawyers (norms, acts and concepts), models based on the ontology can be easily understood; the demand of
clarity is met. The following are benefits from building ontology for e-laws applications:
Semantic matchmaking.
Introducing new legislation depending on previous ones.
Building new intelligent applications using ontology.
Providing support for e-government applications.
Building and supporting e-law expert systems.
Comparing two different legislations.
Harmonizing two different regulations.
Building Bi-lingual e-law matchmaking.

2.2 The Jordan Case

This paper has been based on building e-government applications in Jordan. The experiences from this case can easily be generalized for any other situation. For the Jordan case, two scenarios have been identified:

Scenario 1:

A company plans to invest in Jordan. It sends its agents (soft or human) to check the Jordan laws. They check the laws of: taxes, investments, copyrights, labors, contracts, etc. A matchmaking is needed for these agents. This matchmaking should include semantic, relational, bi-lingual, and keyword matches.

Scenario 2 :
An online court has been held. The lawyers are looking for certain laws and law-cases that can help them. They usually use keyword matching to find these law cases. Jordan, as many countries do, uses their own concepts to define these law cases. There is a need for building a semantic and bi-lingual matching. Through a law ontology these problems can be solved.

3. The Ontology Life Cycle
Building systems using a predefined standard is less complicated than building systems using ontology. The former is simple but not applicable an in open environment. The latter is complex but will move the complexity from the user side to the application building side. This move is needed since we build an application only once but use it many times.

Kayed and Colomb [10] summarize the methodologies for building ontologies around three major stages of the ontology life cycle i.e. Building-Manipulating-Maintaining (see figure 1).

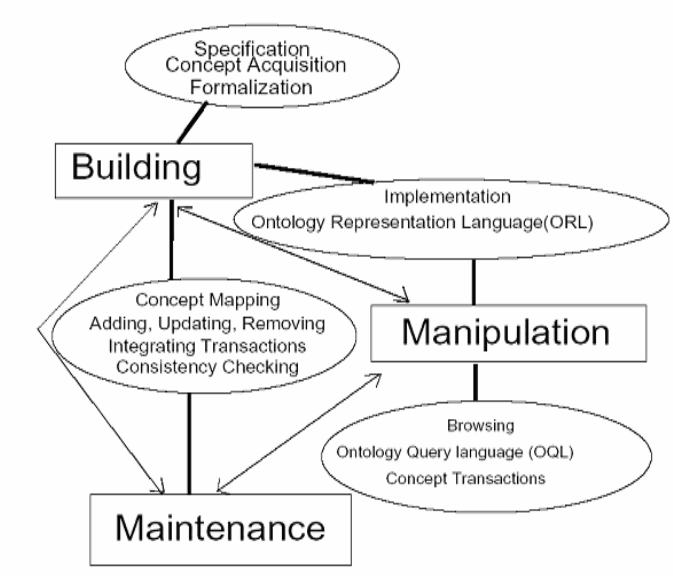

Fig 1. Ontology Life Cycle

3.1 Building stage: There are many attempts to define a methodology for ontology construction. Examples are [4][5][16]. In the building stage, four steps are needed: specification, conceptualization, formalization, and implementation.

Manipulation stage: In the manipulation stage, an ontology query language should be provided for browsing and searching; efficient lattice operation; and domain specific operations.

3.2 Maintenance stage:
In the maintenance part, developers should be able to syntactically and lexically analyze the ontology, adding, removing, modifying definitions, and also translate from one language to another. Ontologies should be built with different levels of generality. This means that different types of updating mechanisms should be provided. For more detail see [16].

4. Building e-laws Ontology

Kayed and Bob introduced the concept of layered ontologies [11]. Defining levels of abstractions facilitates the process of transforming existing resources to ontology. Ontology serves as an abstract data type for concepts in domain. Building a new ontology from scratch is not a simple task. In the concept acquisition process, we need to re-use existing resources to build our ontology. The aim of the concept acquisition process is to facilitate the acquisition, classification, and representation of concepts. Activity tasks include: classification criteria, question scheme, optimization of questions, rules for classifying relations and concept representation [12]. If we agree that ontology is an explicit specification of conceptualization [6], we also need to agree that this knowledge is implicit in many

applications. This knowledge may be abstracted from existing resources.

In this paper, an experiment has been conducted to extract concepts for e-law ontology. Text-mining tools have been used to extract concepts in the domain of e-commerce laws. The following summarizes the steps to build this ontology:

- Collect many law cases for e-commerce.
- Extract top concepts.
- Refine the results.
- Categorize the concepts.
- Define the relationships among concepts.
- Build the ontological hierarchy.
- Formalize the concepts.

4.1 Collect law cases form e-commerce law resources:

REACH is the main source for our e-law ontology. REACH is a core group of members of the IT industry, supported by the AMIR Program (Access to Microfinance & Improved Implementation of Policy Reform - United States Agency for International Development). REACH devised a strategy and action plan initiative for e-commerce. This initiative was conducted through an intensive consultation and research process with Jordanian IT industry leaders , in addition to international and domestic consultants (http://www.intaj.net/resource.cfm\#top). The REACH team has developed a framework for e-commerce laws. This paper uses their results and some law cases related to E-commerce. Four cases have been selected. All these resources have been converted to text format. The original size of these documents was around 1 MB. The converted files have been reduced into 367KB.

4.2 Extract top concepts: *KAON's* texttoont program has been used http://kaon.semanticweb.org) to extract the terms and their relationships. Around 273 concepts have been extracted in this stage. The following is just a sample(for detail see [8]):

industri, develop, service, articl, compani, softwar, project, year, technologi, work, educ, state, countri, program, product, comput, import, park, need, export, invest, busi, agreem, tax, inform, law, sector, system, base, govern, support, qual, certif, annex, applic, firm, manag, reach, univers, custom, purpose, skill, local, corpor, implement, regul, establish, total, time, build, duti, avail, cost, process, employ, organ, train, number, market, activ, zone, case, increase, etc.
*** KAON extracts the common terms not the English terms. For example: the concept (develop) is part of developing, development, developed, etc.*

4.3 Refining terms and re-defining relationships:

KAON has the ability to build the relationships for the extracted concepts. KAON algorithm extracts around 32,000 relationships for the 273 concepts. The size of the file in text format goes beyond 10 MB. It was very hard to discuss these relationships with any domain expert (lawyers). A new algorithm has been developed to reduce these relationships to an acceptable number. The full details of the algorithm will be published in another forum.

The main objective of the algorithm is to group the concepts in a way that the domain expert can look at them. The algorithm will find the group of concepts that have at least one relation with another group. All concepts in the first group must have a relationship with the second one. The algorithm converges

since the increasing of elements in the first group will decrease the number of elements in the second one. The elements in the first group will be chosen by ordering the concept according to the number of relationships that they have. The same steps will be repeated for a second level. In the second level, we look at the second group and group all the concepts that have a relation with all concepts in the second group. The complexity for the algorithm is liner.

This way works well with our e-law ontology domain. The number of relationships has been reduced from 6000 to 39 groups of relationships with two or three levels (see table 1). This enables the domain concepts (lawyers) to define the types of relationships that relate each group. After that, they can define the relationships that relate each element with another element. The number of elements in each group is critical. Increasing the number of elements in the first group will reduce the number of elements in the second group. However, decreasing the first group will increase the second group. The algorithm has been enhanced by running another algorithm that finds the best number of elements in each group. It has been found that the number of elements in each group should be close to each other. It has been shown experimentally, that best number of elements in each group should be from three to five elements. For more details see [8].

The initial concepts, relationships, and algorithms are available via [8]. KAON has been used to extract the concepts from text format files. MS Access and MS Visual Basic have been used to implement the algorithms.

GroupedCon

GroupNo	Levels	Rel	Cons	GroupDesc	Con1	Con2
1	1	607	12	Level: 1 Rel: 607 Cons: 7--->5	industri develop servic articl compani softwar project	annex invest product work zone
1	2	254	12	Level: 2 Rel: 254 Cons: 5--->7	annex invest product work zone	articl compani develop industri project servic softwar
2	1	316	7	Level: 1 Rel: 316 Cons: 5--->2	year technologi educ state countri	industri product
3	1	229	8	Level: 1 Rel: 229 Cons: 4--->4	program comput park import	busi develop industri univers
3	2	94	18	Level: 2 Rel: 94 Cons: 2--->16	busi univers	access accredit comput develop faculti http import industri park program promot result state support system technologi
3	3	225	10	Level: 3 Rel: 225 Cons: 8--->2	access accredit faculti http promot result support system	busi univers
4	1	160	8	Level: 1 Rel: 160 Cons: 3--->5	need export agreem	approv area develop servic technologi
4	2	61	10	Level: 2 Rel: 61 Cons: 2--->8	approv area	agreem busi cippm export need project trade zone

Fig 2. Table 1

4. Conclusions

Building ontology is moving from being craft to being science. We study the use of existing resources(data and tools) to build ontology for e-commerce applications in the domain of e-laws. E-commerce laws have been collected, existing text-mining techniques have been used, basic concepts and relationships have been identified. It has been noted that the number of concepts and the relationships were very huge. New techniques are need to reduce the number of relationships. We are working in grouping the concepts according to the number of relationships. Each group may be linked with other group if and only if each element in the first group has at least one relationship with the second group. We are developing algorithm for this technique.

Extracting concepts is not a hard task. Defining relationships for an ontology still depends on the domain expert and needs much more effort. This new algorithm will help the domain expert in defining and refining these relationships.

We are now looking to implement the ontology using Ontology Web Language(OWL), and to build relational matching which we defined in [9]. This will enable and support the reasoning process in many law expert systems.

Acknowledgment

This work has been supported by the school of CIS at the Applied Science University and by the School of Network Computing at Monash University. The author likes to thank many anonymous people for their efforts to improve the readability of this paper. I would also like to thank Hanin for her assistance in proofreading the paper.

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