A Digital Preservation-Legal Ontology

Marzieh Bakhshandeh[1,2], Barbara Kolany-Raiser[3], Gonçalo Antunes[1,2],
Silviya-Aleksandrova Yankova[3], Artur Caetano[1,2] and José Borbinha[1,2]
[1]*Instituto Superior Técnico, University of Lisbon, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal*
[2]*Information Systems Group, INESC-ID, Rua Alves Redol 9, 1000-029 Lisboa, Portugal*
[3]*Institut for Information, Telecommunication and Media Law (ITM), Muenster, Germany*

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Abstract: Digital preservation has the goal of ensuring long-term access to data, enabling future users not only to benefit from today's knowledge, but also to reuse such knowledge. Therefore, the digital preservation of a business process has the aim of enabling the use of the preserved process data so that its re-execution is possible. Law is becoming an essential application domain for technology developments, such as digital preservation. For instance, the digital preservation of copyright protected data might infringe the exclusive rights of the copyright holder. However, problems with the legal domain can arise since DP users and law-makers do not share the same perspective and concepts. Ontologies can be used to improve communication and shared understanding, giving rise to greater reuse, sharing, transparency, and interoperability. This paper presents a legal ontology that provides a hierarchical overview of how legal constraints and obligations (e.g. IP rights and licensing issues) could be enforced automatically in DP systems. The correctness of our legal ontology is validated with a set of competency questions defined in a specific case study. The aim is to obtain a clearer taxonomical view of the necessary legal knowledge that will address the concerns of industrial use-case DP stakeholders.

1 INTRODUCTION

Digital Preservation (DP) can be considered an imperative challenge for the information society (Chanod et al., 2010). The need for preservation has been recognized for quite some time, especially by scientific and cultural heritage institutions (Brunsmann et al., 2012). A novel approach closest to the business domain has been introduced by the EU project TIMBUS[1] which seeks to leverage this expertise pool to implement solutions capable of preserving dynamic digital objects, such as business processes and services (Edelstein et al., 2011). As such, efforts are being put into describing whole processes and capturing their complete inter-dependencies and constituent components, along with their configurations, in order to be be able to re-deploy and re-execute them in the future (Strodl et al., 2013). An inseparable element of every DP activity is ensuring the authenticity and legitimacy of the performed actions and processes (Ma et al., 2009).

The need for addressing legal issues and obligations in the DP domain is manifest: almost every process of a DP system may infringe a right, among other legal requirements and constraints, e.g. contracting issues and licensing (Hoeren et al., 2013). An ontological approach to organize legal information and requirements could help with the legal perspectives and concerns making it a pivotal element of any DP system. Therefore, a taxonomy in the form of an ontology can be instantiated to form a knowledge-base, which would then allow a DP expert to acquire and express inferred legal knowledge through the contents of the ontology.

Such ontology would be a beneficial source of hierarchical knowledge to the experts and stakeholders, particularly in the DP domain that has an inherent and inseparable legal-compliance element to it. It is, also, noteworthy that ontologies facilitate knowledge engineering, knowledge extraction, and consistency/conformity checking (Burger and Simperl, 2008). Put simply, they could help us to properly retrieve what we have stored, e.g. specific rules and laws. Whether one is a common lawyer or an expert in a non-legal field, they could greatly benefit from browsing through a legal taxonomy and its hier-

[1]http://timbusproject.net/

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archical classification. The ontology-based approach to capture and formalize legal information is, therefore, about shifting power towards business experts, domain experts, and industrial use-case owners, thus representing a business centric approach. Ontologies can help us with this problem and, therefore, could be a sensible solution to achieve our goal of creating a common understanding of the meaning of legal concepts and terms, thus mitigating the risk of misinterpretation, particularly in legal applications. They could, effectively, fulfill this objective by providing contextual explanation and precise legal information. The importance of this technology is evidenced by the growing use of ontologies in a variety of application areas, especially by their role on the Legal areas as witnessed in (Mommers, 2001),(Visser and Bench-Capon, 1996), (Valente et al., 1999), (van Kralingen, 1997), (Breuker et al., 2009) and (Sartor et al., 2011), (Agnoloni et al., 2009), (Dhouib and Gargouri, 2014), (Lehmann et al., 2004), (Breuker et al., 2005), (Cornoiu and Valean, 2013) (Capuano et al., 2014). Most of these legal ontologies focus on the process used for building ontology from a legal corpus given in natural language, there has not been any legal ontology build in the digital preservation area. The preservation of digital objects and the reuse of them in the future are influenced by legal requirements. This has effects on all aspects of the preservation challenge: business constraints, process descriptions, computational environments and their mutual dependencies, digital assets that are produced and consumed by the processes, roles of individuals and organizations, and dependencies on third-party products and services

The remainder of this paper is organized as follows. Section 2 describes the definition of digital preservation architecture models. Section 3 describes the ontology and realization of that in toward a legal ontology for the digital preservation. Section 4 evaluates the solution using a scenario. Finally, Section 5 concludes the paper.

2 DIGITAL PRESERVATION

Digital preservation can be defined as a set of activities, techniques and methods applied to digital objects to ensure that they remain accessible and usable (Hedstrom, 1997). In order to ensure that, it is necessary that the different levels of a digital object are accounted for (Thibodeau, 2002): the physical object, which concerns the way information is encoded in the storage medium; the logical object, which concerns the way the object is represented so that it can be processed by software; and the conceptual object, which concerns the understandability of the object by people that want to use it.

As such, in order to ensure that the informational content of an object can be accessed, there is the need for a technological context provided by the combination of specific hardware and software that is able to process the physical and logical object. Usually, information concerning that technological context is captured and associated with the object, being usually referred to as "technical metadata" (Borbinha, 2004). A standard reference model, the ISO 14721 (ISO, 2003), abstractly defines the activities surrounding the preservation of digital objects, additionally providing a data model for supporting the capturing of the required contextual information.

While the determination and acquisition of this contextual information can be challenging when dealing with static objects (e.g., images, documents, etc.), arguably it becomes even more challenging when dealing with complex digital objects such as workflows or business process specifications (Mayer et al., 2012). Business processes are increasingly supported by technology, a fact which, on the one hand creates opportunities, and on the other hand, increases the challenges and responsibilities. New requirements which might involve greater traceability, accountability, and trustworthiness, which preservation can address.

The TIMBUS project focuses on tackling the challenges surrounding the preservation of business processes. As with any other digital object, the preservation of a business process requires that the contextual information is preserved along with it, allowing the future redeployment and re-execution of the process. However, when dealing with such digital objects, usually a complex contextual dependency network is involved. That network might encompass highly complex and distributed technological infrastructure, which is hosted in diverse organizational settings, which sometimes crosses multiple organizations (Neumann et al., 2012). Correctly determining, capturing, and representing this information is crucial not only for the correct rendering and processing of such objects, but also to be able to understand their original purpose or motivation. In order to avoid legal conflicts and infringements, we initially designed, implemented, and published (Hoeren et al., 2013) exhaustive clauses regarding DPs legal issues, including Digital Escrow Services that ensure that software systems.

3 LEGAL ONTOLOGY

The term *ontology* comes from the Greek ontos (being) + logos (word). Which, literally means existence (Breitman et al., 2007). From the perspective of philosophy, ontology is the systematic explanation of being (Gomez-Perez and Benjamins, 1999). In computer science, the most widely used definition characterizes ontologies as "formal, explicit specification of a shared conceptualization" (Gruber, 1993).

The ontology building process is more of a craft, rather than an engineering activity (Fernández-López et al., 1997). Every development team usually follows its own set of principles, design criteria, and phases in the ontology development process. However, there are a series of well-known methodologies that have been proposed for building standard ontologies. The design approach employed in this work is an adaptation of Horridge (Horridge et al., 2004). The steps include: (1) identification of the concepts and concept hierarchy; (2) identification of the disjoint concepts; (3) modeling composition; (4) addition of all the relationships between concepts; (5) identification of definitions; (6) addition of annotations; (7) and refinement of the ontology through various iterations of the above steps. Most ontology building methodologies propose iterative approaches in order to allow formalization to be accomplished progressively.

The work was stated by gathering information process and having several meetings between the media lawyers, digital preservation experts and information system engineers. In this work, we follow an iterative approach by using conceptual maps as a "bridge" between the legal taxonomy and the formal specification. For the first phase, the concepts and their relationship were drawn in a Conceptual Map model. This conceptual map has been validated in an iterative fashion, to several meetings. Figure 1 depicts a representation of the conceptual map used to develop our Legal Ontology. We have used a conceptual modeling tool to progressively detail the model. In figure 1 we can see a conceptual map of the legal perspective. In this description the concepts are written in bold and the relationships are in italic:

As we live in a society where there are legal rules for the conduct of **Legal Persons**, their **Actions** *NeedToComplyWith* the **Legal Requirements** imposed by the law. A **Legal Requirement** means generally everything that is demanded or imposed as an obligation by law. As a matter of course, **Legal Requirements** *DifferAccordingTo* the **Location** where **Legal Persons** *carryOut* their **Actions** because the legal rules in each country are different and depend on the national legislation.

DigitalPreservation as such an **Action** *NeedToComplyWith* **Legal Requirements** as well. Regarding **DigitalPreservation**, the most relevant **Legal Requirements** are **Data Protection**, **IP-Rights**, *ObligationsToPreserve* and **Contract**ing. In order to lawfully preserve **BusinessProcesses** each **Legal Person** has to be aware of legal restrictions, conduct lawabiding and fulfill its legal obligation.

For example, legal **ObligationsToPreserve** which require **DigitalPreservation** already exist. Such **ObligationsToPreserve** can be generally found especially in the areas of tax law (annual balances, invoices, etc) or medical law (the health records of patients) where it appears essential that specific **Data** files need to be archived for a long period of time. **Artifacts** like **Software**, **Databases** or other types of **Data** *CanBeProtectedBy* **Copyright**.

In order to be able to digitally preserve them without any infringement of **IP-Rights**, a **Legal Person** has to be aware how far the protection of these **Artifact**s reaches and whether preservation **Action**s/Methods like Migration or Porting are allowed. While **Software** is usually a subject of **Copyright** protection, **Data** and **Database**s need to fulfill more specific criteria to be protected by **IP-Rights**. **Database**s for example *CanBeProtectedBy* either **Copyright** if they constitute the author's own intellectual creation; or if that is not the case, they have simply **ProtectionSuiGeneris** if their maker has made a substantial investment. According to the differing scope of protection different methods and technics for **DigitalPreservation** are permissible.

The scope of **IP-Right** protection *CanBeDefinedBy* not only national law or European directives but by **Contract**s as well. Due to the fact that **Legal Person**s *AreRightholderOf* **Software**, they *CanGrant RightOfUse* to other **Legal Persons** by signing (*CanSign*) a **Contract**. These **Contract**s are usually **License**s or **Sale Contracts** and **Software** *canBeDeliveredOnTheBasisOf* of these **Contract** types. Thus, not only the author and original rightholder of the **Software** but other **Legal Persons** as well can be authorised to use the **Software** and obtain **RightofUse**.

In this sense, some aspects of **Copyright** like the *RightofUse canBeDeterminedIn* **Contract**s. For example, the licensor *CanGrant* the licensee the right to freely modify or migrate the **Software** in a **License Contract** and thus make **Action**s necessary for the execution of **DigitalPreservation** legally feasible. In case that one **JuridicalPerson** like a company offers **DigitalPreservation** as a service for other **JuridicalPerson**s, they *CanSign* a **ServiceContract** and define the particular parameters of appointed service level in an annex to the **Contract** called **ServiceLeve-**

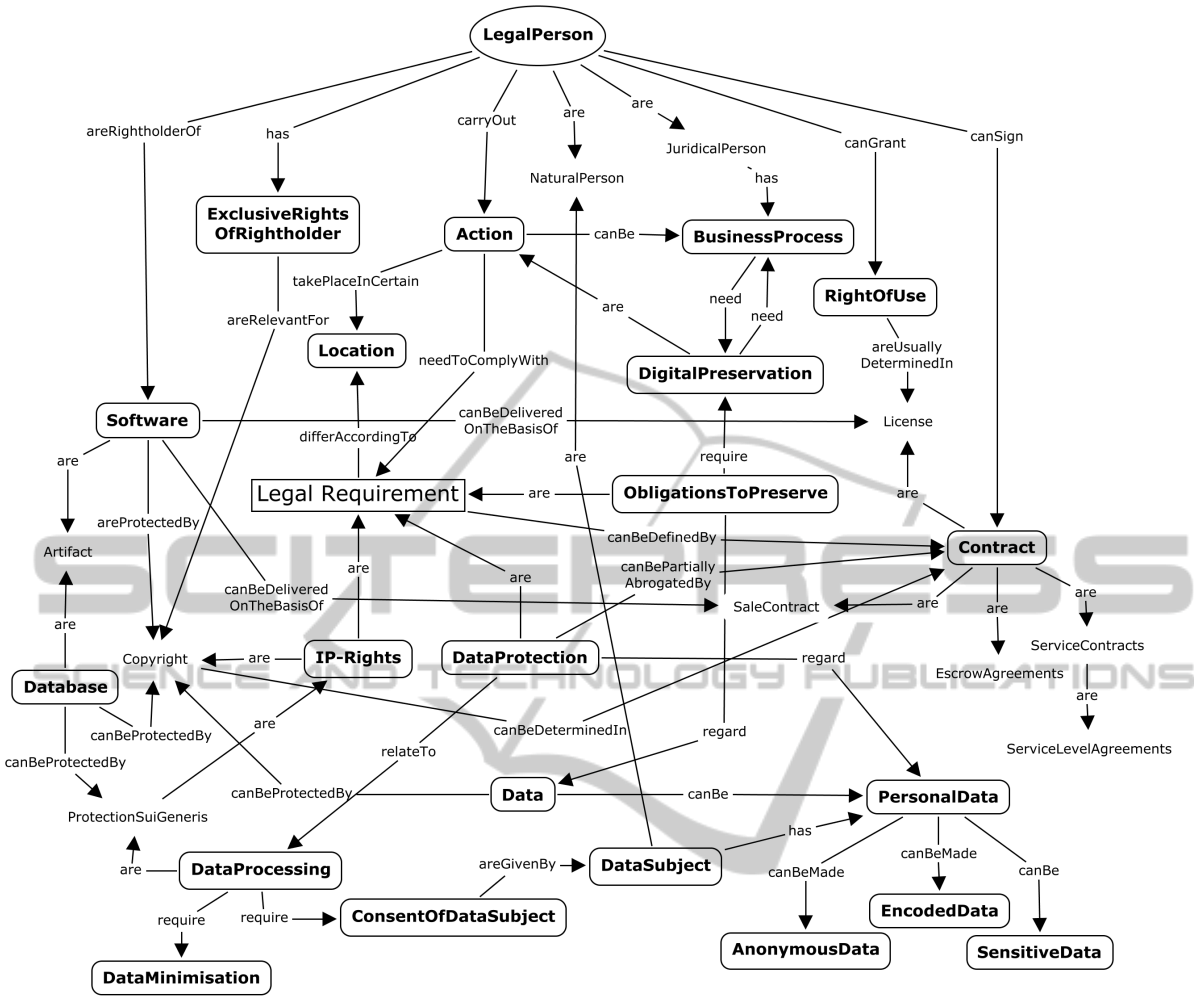

Figure 1: Conceptual Map of Legal Concepts and Relationships.

lAgreements.

Data *CanBe* related to an identified or identifiable **NaturalPerson** and therefore *CanBe* **PersonalData** or even **SensitiveData**. Such **Data** needs legal protection from any acts of **DataProcessing** which are unwelcomed by the **NaturalPerson** to whom the **PersonalData** belongs. This due to the principle that every **NaturalPerson** has the right of informational self-determination and the right of privacy. Therefore, privacy security and Data Protection are essential **Legal Requirements** and the compliance with them is monitored by public authorities.

Thus, if **Data** is digitally preserved it has to be guaranteed that the **Action**s necessary for **DigitalPreservation** are compliant with (NeedToComplyWith) the rules of **DataProtection**. One basic concept of **DataProtection** is that **DataProcessing** requires the **ConsentOfDataSubject**. The **NaturalPerson** to whom the **PersonalData** belongs is called in this sense **Datasubject**. The *ConsentOfDataSubject* has to be given in advance regarding the specific process and cannot be generic. A way to be compliant with the rules of **DataProtection** can be to hide the personal component of **Data** as well as the connection between the certain **Datasubject** and its **PersonalData** by transforming the **Data** to **AnonymousData** or **EncodedData**.

The legal conceptual map was used as the input to create the ontology, using the OWL representation. The concepts contained in the concept map were mapped into OWL classes. Relations were mapped into OWL ObjectProperties, and restrictions were added into those properties: InverseObjectProperties and SuperObjectProperties axioms were added to the OWL ontology. Cardinalities were also added to some of the concepts and relations. Furthermore, some DataProperties were defined. This ontology was built in the tool Protégé[2].

[2]http://protege.stanford.edu

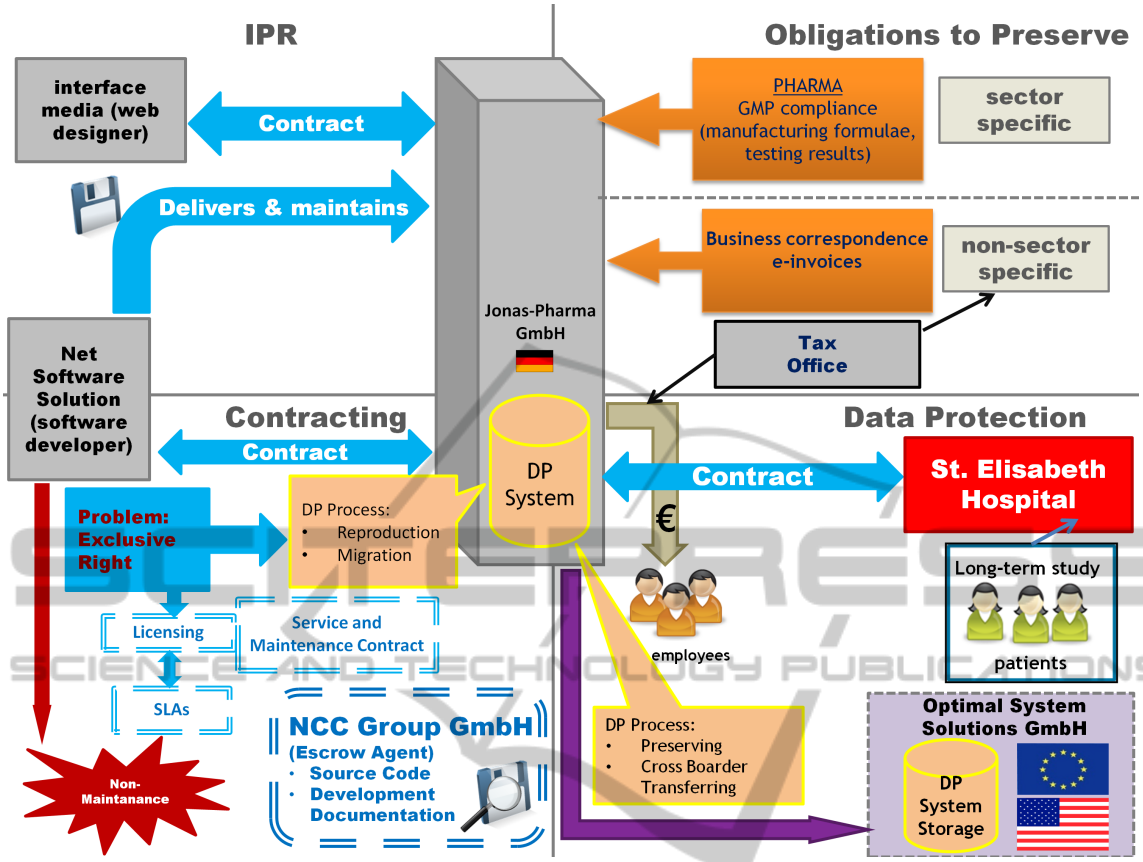

Figure 2: Case Study.

4 CASE STUDY AND VALIDATION

Figure 2 depicts the case study. Jonas-Pharma GmbH is a Pharmaceutical Company with its headquarters in Cologne and enters into a License Contract with a Software Development Company Net Software Solution in order to use the software Iris created by the Software Development Company. The Jonas-Pharma GmbH wants to digitally preserve the relevant data of their business processes including the software Iris. Consequently, the necessary rights of use must be granted in the License Contract. The rights of reproduction and migration and alteration are essential for digital preservation. In the given scenario, the necessary rights are not explicitly included. Consequently, an amendment agreement is required granting the necessary rights for digital preservation. The software Iris is copyright protected. Copyright belongs to the IP-Rights.

The Net Software Solution owns the exclusive rights of the software Iris. As rightholder, Net Software Solution can grant the necessary rights of use to Jonas-Pharma GmbH. Furthermore, the two parties enter into a Service and Maintenance Contract regarding the software Iris. Details are defined in the Service Level Agreements. The software is very important for the workflows of Jonas-Pharma GmbH. Consequently, Jonas-Pharma GmbH must take precautions, for example in case of non-maintenance of the software. That is why two companies sign an Escrow Agreement.

They decided their Escrow Agent should be NCC Group GmbH whose head office is located in Munich. All relevant material, such as the source code and the development documentation are stored at NCC Group GmbH the Escrow Agent. In case of a triggering event, for example the non-maintenance of the software by Net Software Solution, Jonas-Pharma GmbH receives the material in order to be able to maintain the software or do necessary corrections and/or updates. Jonas-Pharma GmbH has to comply with certain legal obligations to preserve data. Noncompliance of a company with its obligations to preserve data can result into damages, an administrative

offence or even a crime.

For example, all data relevant for accounting and fiscal purposes must be preserved. This includes for example e-invoices and emails containing business correspondence. These are so-called non-sector specific obligations. Furthermore, pay roll information must be preserved containing personal data of the employees of Jonas-Pharma GmbH. Data Protection requirements must be fulfilled. The employees must consent to the preservation of the pay roll information which includes their personal data or a legal permission must exist. The employees have to consent to each data processing operation, a general consent is not sufficient.

As a sector-specific obligation, Jonas-Pharma GmbH has the obligation to retrain the batch documentation of the different medical products. For example, manufacturing formulae and testing results must be preserved. The competent national or European authorities can control Jonas-Pharma GmbH and demand access to the stored data.

In addition, Jonas-Pharma GmbH hires interface media to design a web-page. Interface media has an office in Zurich. Both parties enter into a contract. The contract contains a so-called duties record book summarizing the expectations of Jonas-Pharma GmbH with regard to type, scope, structure and functionality of the web-page. In the contract, the duties to cooperate of the Jonas-Pharma GmbH are specified, which has a content management tool, called WordPress. Interface media holds the copyright. The necessary rights of use are granted exclusively, irrevocably and without restrictions in time or space to Jonas-Pharma GmbH. However, the granted rights of use are limited to the use of the webpage or rather parts of it in the internet.

Additionally, Jonas-Pharma GmbH and the Interface media enter into a Service and Maintenance Contract. Details are defined in the Service Level Agreements. The web-page includes the possibility for medical practitioners and pharmacists to access a closed forum after having completed a registration process. Personal data such as the name, day of birth as well as the completion of a medical or pharmaceutical study must be provided. With regard to Data Protection, the medical practitioners and pharmacists must consent to each data processing operation. Within the closed forum, the medical practitioners and pharmacists are provided with detailed information with regard to the medical products.

Furthermore, Jonas-Pharma GmbH informs the professionals about new medical products and initiates an exchange between the experts. The web-page also contains a search engine tool to help the user find the relevant information about the drugs and their side effects, the search engine tool uses ABDA databases which contain comprehensive data concerning medicinal drugs and substances as well as drug-related information and has time protection for more than fifteen years. This drug information analyses process and all the other business process is also digitally preserved. Jonas-Pharma GmbH wants to digitally preserve this drug information analyses process for liability reasons with regard to the search result, so they can re-run the business process later in the event of litigation.

The Jonas-Pharma GmbH company cooperates with the St. Elisabeth hospital in Vienna who carries out medical studies. Therefore, Jonas-Pharma GmbH and the St. Elisabeth hospital have entered into a work contract. One long-term patient study examines the efficiency of a drug aiming at minimizing the symptoms of an incurable disease. The St. Elisabeth hospital uses the data of different patients, which have consent to each data processing operation necessary for the processing and utilization of the results. The patients are examined at regular intervals. Consequently, the hospital must be able to assign the gained information to a certain patient. Therefore, the data is only encoded which was Programmed by Net Software Solution.

This patient encoding data process is carried out be St. Elisabeth hospital. As the medical study is a long-term study, it is important that the hospital can add new results which are gained every six month. The Encoding data analyses tool has also a function to decode the encoded data with the patient decoded data process, so the new results can be added to the already existing results in the patient's files. Only encoded data is transferred to Jonas-Pharma GmbH where it shall be digitally preserved. After implementing the scenario in the legal ontology we had to validate the legal ontology by performing reasoning and inference over legal knowledge and information.

According to(Fox and Gruninger, 1998) one of the ways to determine the scope of the ontology is to sketch a list of questions that a knowledge base based on the ontology should be able to answer. We have applied reasoning queries (competency questions) to our Legal Ontology. The goal here is to ensure consistency/conformity and attain specialized legal information for the DP of whole business processes and services. A set of predefined competency questions were used in order to validate ontology. Some of the competency questions defined to validate the legal ontology (due to the lack of space we could not represent more) is composed by the following questions, with the respective results being depicted in Figure 3:

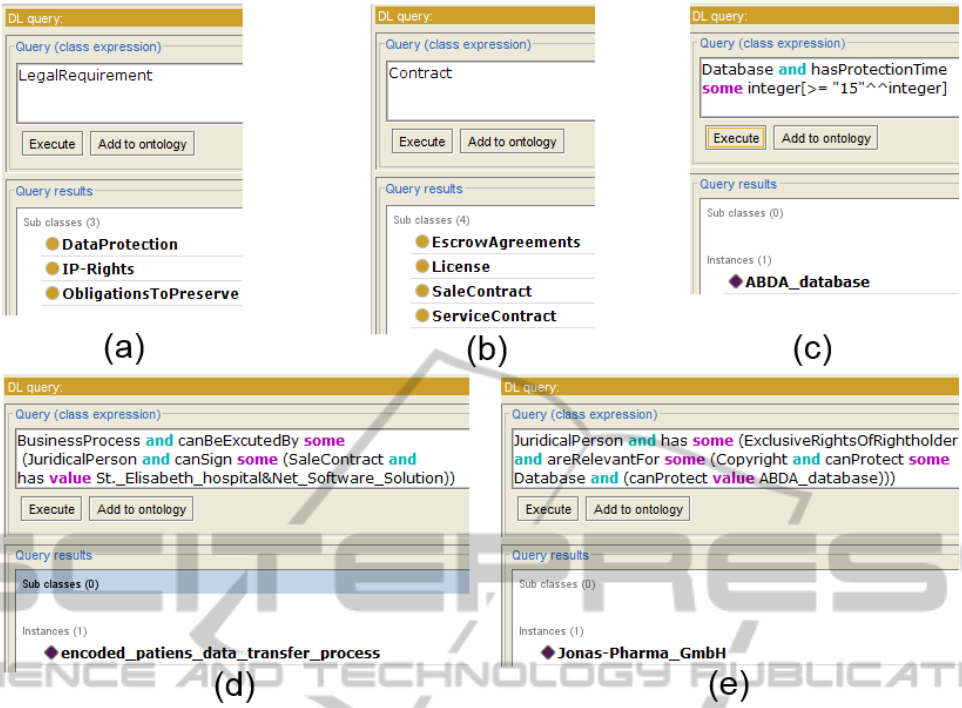

Figure 3: Query Results.

- (a) Which are the basic legal requirements regarding digital preservation?
- (b) Which type of contracts exist in the case of digital preservation
- (c) Which database has 15 years time protection by copyright?
- (d) What is the business process that exists between the St. Elisabeth hospital and Net Software Solution company?
- (e) Who has the exclusive right of the copyright holder for the ABDA database?

5 CONCLUSIONS

This paper proposes using ontologies to integrate law perspective with digital preservation domain. Ontologies describe a domain model by associating meaning to its terms and relations. The importance of this technology is evidenced by the growing use of ontologies in a diversity of application areas. A legal ontology was made for the digital preservation domain. This unifying Legal Ontology is intended to function as a lingua-franca to facilitate the translation and mapping between different perspectives, as well as reasoning and inference over legal information in the domain of digital preservation. Next, the legal ontology was validated by a set of competency questions through a specific case study. This validation was processed with reasoning methods.one of the limitation of our Digital Preservation-Legal Ontology was that it couldn't answer some of the legal question that the answers were yes/no. Future work will focus on the application of this approach to new scenarios in order to discover the analysis possibilities, considering the usage of different reasoning and querying techniques.

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