



THE CONVERSION OF THE HIGHER EDUCATION AND LITERATURE ONTOLOGY INTO RELONTOUML

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Abstract. In this article, I will transform an ontology representing higher education and an ontology representing a library into the RelOntoUML model. RelOntoUML modeling is a modeling created from a combination of relational model, ontology, and UML modeling. The relational model is used for database storage. The data is stored in relations. Ontology is a tool for knowledge representation. The ontology describes the elements of a topic. The UML model visually represents the elements of a topic. One of the disadvantages of the ontology model is that software developers are not familiar with it, but UML diagrams and the relational model are well known. The two models (CollageMngt-Sys, Literature) that will be presented and converted can be downloaded from the github in OWL format, and are open source. In this article, after introducing the ontology, relational model, and UML, these two systems are introduced and converted.

Keywords: ontology, OWL, UML, relational model, RelOntoUML

1. Introduction

In this article, a model representing higher education and a library is presented. Modelling a system is an important task in all phases of software development. In the initial phase, it gives software developers a framework for the software. After the software (functionality) has been developed, it is part of the documentation. UML [1] is a modelling language well known to software developers, one of the best known diagrams of the UML is the class diagram. Not only can we use the ontology [2] for modelling, it provides more. It assumes an open world, so the statement that is not false is true in the ontology. With the help of the inference engine we can infer many statements. For example, if a property is transitive, and if the property points from A to B and from B to C, then the property also points from A to C. OWL [3] is the Web Ontology Language that allows us to describe the ontology of a system

in XML-like terms. It is not necessary to describe the ontology in OWL ourselves, Protégé [4], which is a graphical editor, helps us to do this. Database models model the structure of a database, one of the most common being the relational database model [5]. The relational database model consists of tables with columns representing each category and rows representing a value. The cross section of the column and the row represent data. In the following, I present two models (CollageMngtSys [6], Literature [7]) and the conversion of these two models into the RelOntoUML [8] model.

2. Presentation of a model representing higher education (CollageMngtSys) and Literature

In this chapter, I present two ontologies. The first describes higher education (CollageMngtSys [6]) and the second is the Literature [7]. The conversion to the RelOntoUML [8] model is also presented. CollageMngtSys [6] describes a university. It describes ‘Events’, ‘Library’, ‘Person’, ‘Project’, ‘Publication’, ‘Course’. These classes also have subclasses. Some classes also include individuals such as ‘Network’, ‘AI’ or ‘HCI’. It also categorizes also as Workers ‘Administrative Worker’ (‘AdminisitrativeStaff’), Researcher (‘ResearchAssistant’), Student (‘UGStudent’) and Instructors (‘FullProfessor’, ‘AssistantProfessor’, ‘AssociateProfessor’, ‘VisitingProfessor’). The main class, like any other ontology, here is also the ‘owl: thing’. Figure 1. shows the OntoGraf [10] visualization that can be easily viewed with the Protégé [4] editor. This visualization technique shows classes and individuals.

VOWL [9] visualization is also part of Protégé. Here we plot the ontology graphically. However, the graph is very tangled and unreadable in large ontologies. Here we also show the class sizes, the properties of the classes. The VOWL visualization for CollegeMngtSys is shown in Figure 2. In the RelOntoUML [8] visualization, we can see that the ‘Event’ class in the system contains ‘endTime’, ‘startDate’, and ‘startTime’ data type properties that are of type dateTime. In the first level there is the ‘owl: Thing’, in the second level there are the following classes: ‘College’, ‘Course’, ‘Event’, ‘Library’, ‘Person’, ‘Project’, ‘Publication’. In the third level, the following classes are: ‘Department’, ‘ResearchGroup’, ‘PGCourse’, ‘PhD’, ‘UGCourse’, ‘Conference’, ‘Meeting’, ‘Presentation’, ‘Workshop’, ‘PGLibrary’, ‘UGLibrary’, ‘Employee’, ‘Student’, ‘DevelopmentProject’, ‘ResearchProject’, ‘Article’, ‘Book’, ‘Journal’. The system contains only three individuals, ‘HCI’, ‘AI’, ‘Network’.

Literature [7] is a small ontology; it does not contain many classes and individuals. There are 5 levels in the class hierarchy, but there are only one or two classes in each level. The first level contains the ‘Thing’, the second level contains the ‘Author’ class, the third level contains the ‘Book’, the

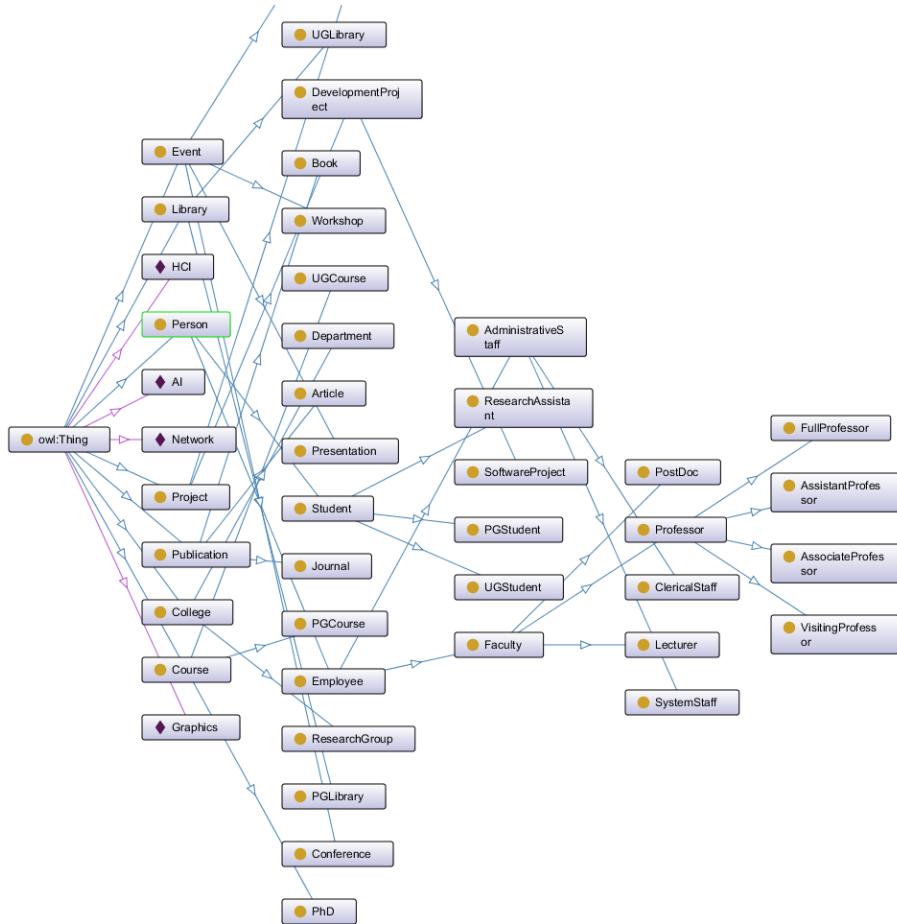


Figure 1. Visualization of College Mngt Sys as Ontograf

fourth level contains the 'Fiction' and the fifth level contains the two classes: 'Murder_Mystery', 'Science_Fiction'. A single class contains only individuals, the 'Author', which contains the following entities: 'John_Steinbeck', 'Ernest_Hemingway', 'Mave_Binchey', 'James_Agee', 'PD_James', 'James_Joyce', 'John_Grishom', 'Ken_Follet', and so on. A representation of Literature as OntoGraf is shown in Figure 4 and a VOWL diagram is shown in Figure 5.

The Figure 6 illustrates the RelOntoUML [8]. It can be seen that the ontology does not consist of many classes. The advantage of RelOntoUML modelling

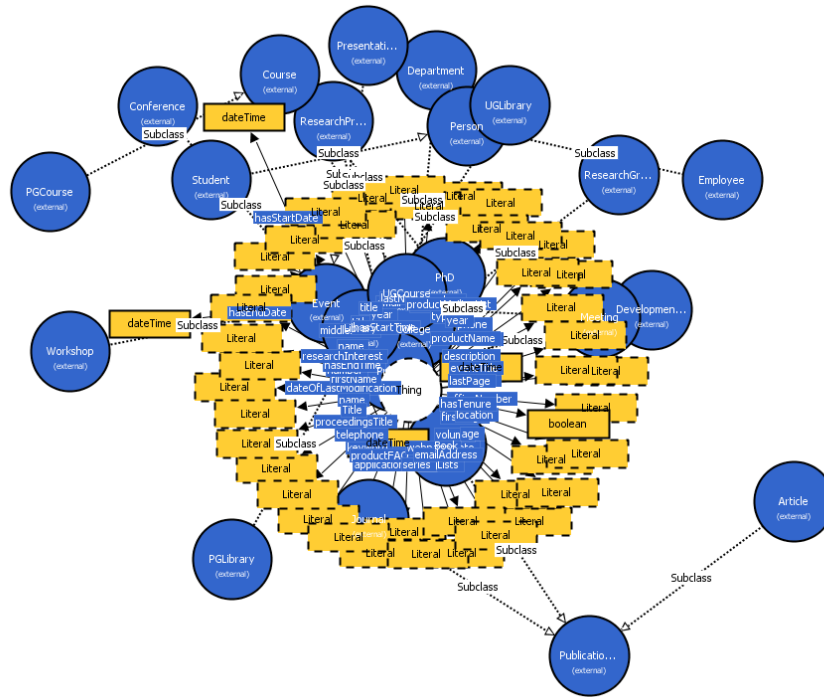


Figure 2. Visualization of College Mngt Sys with VOWL

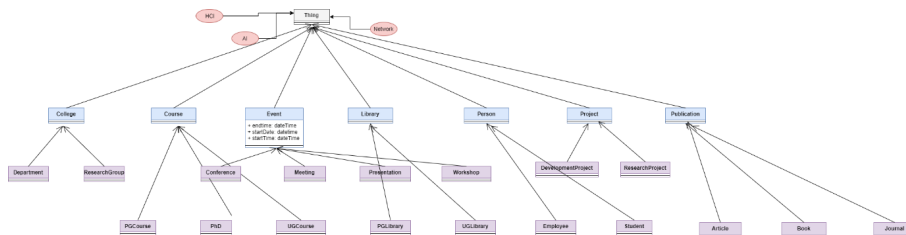


Figure 3. Visualization of the College Mngt Sys with RelOntoUML

is that it contains classes, individuals, and all the properties associated with them in a single diagram, as favoured by software developers

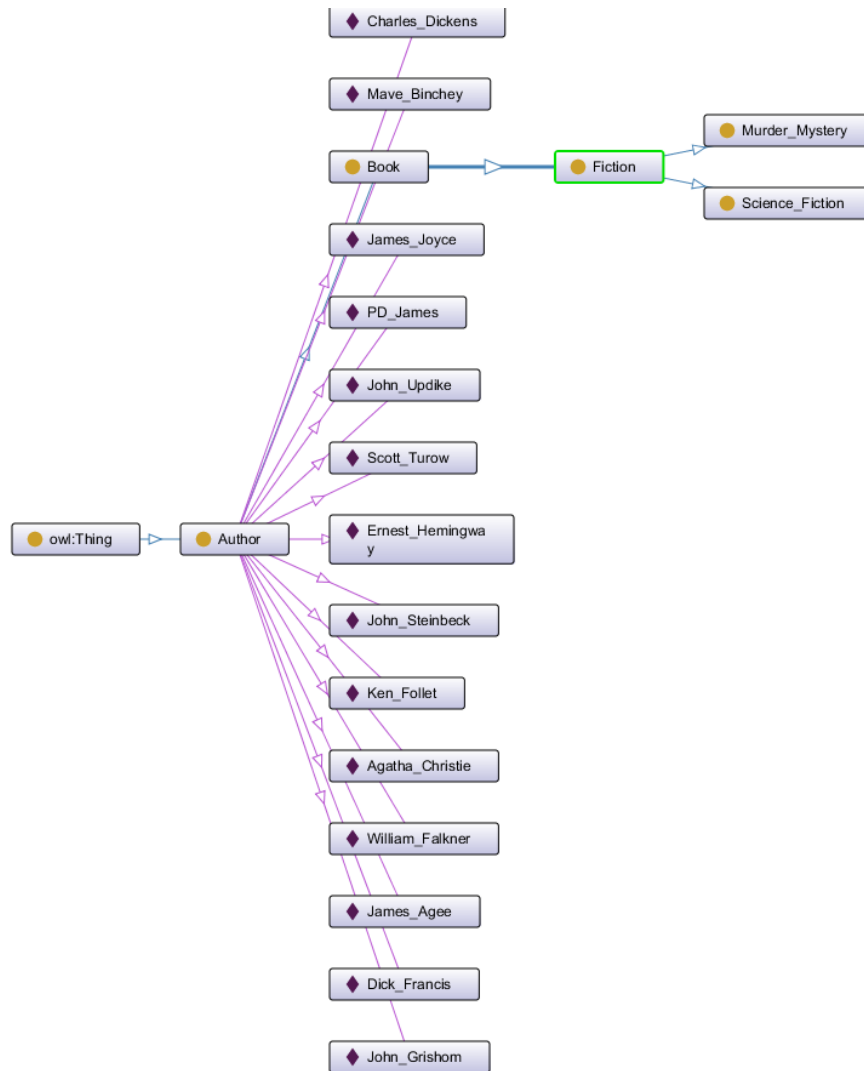


Figure 4. Visualization of Literature with Ontograp

3. Summary

In this article, two ontologies are presented: an ontology describing a higher education institution and an ontology describing the literature. The two ontologies are downloaded from github, they are open source projects. These two ontologies are transformed into the RelOntoUML model, which made the representation of ontologies even more readable and understandable for software

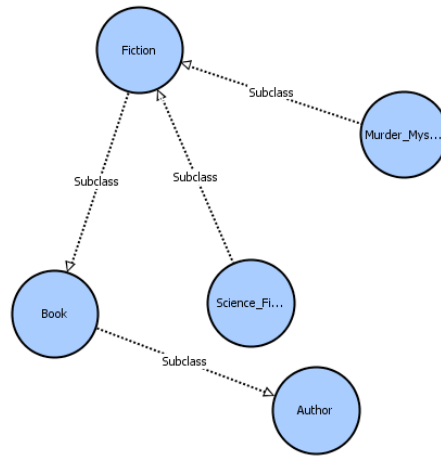


Figure 5. Visualization of the Literature with VOWL

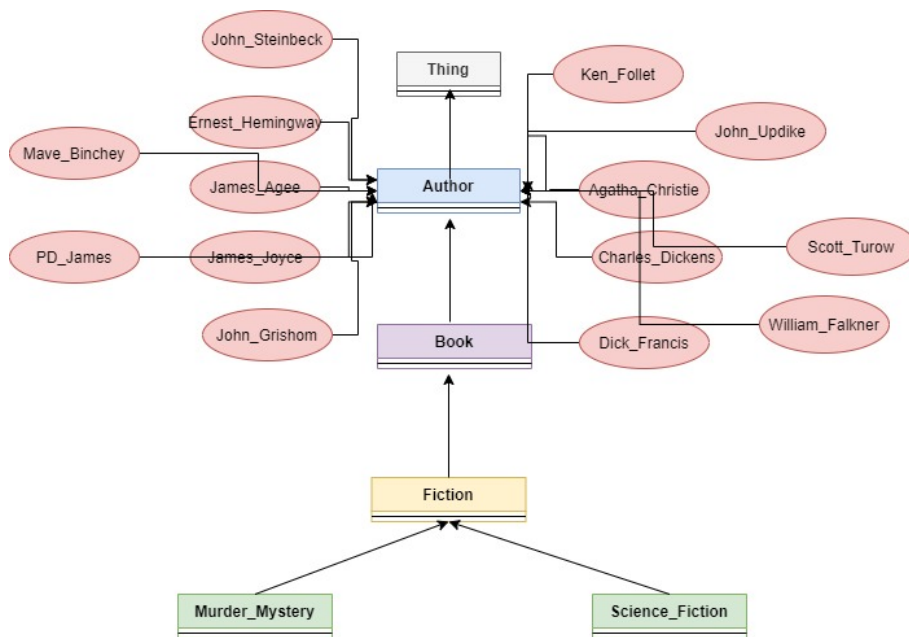


Figure 6. Visualization of the Literature with RelOntoUML

developers. Both models contain classes, a hierarchy of classes. Classes also contain properties and have individuals. My further research plan is to refine

RelOntoUML' model, to analyze other ontologies that can be downloaded from the Internet.

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References

- [1] *UML* <https://www.uml.org/> (Accessed: 2022.05.14.)
- [2] *ontology* [https://en.wikipedia.org/wiki/Ontology_\(information_science\)](https://en.wikipedia.org/wiki/Ontology_(information_science)) (Accessed: 2022.05.14.)
- [3] *Web Ontology Language (OWL)* <https://www.w3.org/OWL/> (Accessed: 2022.05.14.)
- [4] *Protégé* <https://protege.stanford.edu/> (Accessed: 2022.05.14.)
- [5] *Relational database model* <https://www.oracle.com/database/what-is-a-relational-database/> (Accessed: 2022.05.14.)
- [6] *CollageMngtSys* <https://github.com/ayesha-banu79/Owl-Ontology> (Accessed: 2022.05.14.)
- [7] *Literature* <https://github.com/detnavillus/rdf-owl-ontologies.git> (Accessed: 2022.05.14.)
- [8] AGÁRDI, A. *RelOntoUML: Development of a model based on relational model, ontology and UML*. Műszaki Tudományos Közlemények (accepted)
- [9] *VOWL* <http://vowl.visualdataweb.org/> (Accessed: 2022.05.14.)
- [10] *OntoGraf* <https://protegewiki.stanford.edu/wiki/OntoGraf> (Accessed: 2022.05.14.)