TAGOOn+: Generation and Integration of Organizational Ontologies

Karen Najera[1,2], Blanca Vazquez[1,2], Alicia Martinez[2], Anna Perini[3], Hugo Estrada[1,2], and Mirko Morandini[3]

[1] Fund of Information and Documentation for the Industry - INFOTEC, Mexico
{karen.najera, blanca.vazquez, hugo.estrada}@infotec.com.mx
[2] National Center of Research and Technological Development - CENIDET, Mexico
{amartinez}@cenidet.edu.mx
[3] Bruno Kessler Foundation - IRST, Center for Information Technology - FBK,Italy
{perini, morandini}@fbk.eu

Abstract. We present TAGOOn+, a tool that supports: 1) the automatic generation of organizational ontologies from models expressed with i*, Tropos and Service-Oriented i*, and 2) the automatic integration of those organizational ontologies with generic or domain ontologies.

Keywords: iStar, organizational modeling, ontology, ontology integration, Model-Driven Engineering.

1 Introduction

TAGOOn+[1] is a tool that automatically generates organizational ontologies and automates their integration with other ontologies. It has two main purposes:
1) It supports the automatic generation of organizational ontologies from organizational models expressed with i*, Tropos and Service-Oriented i* [2]. To do this, the ontological metamodel for these variants, called OntoiStar+ [3] has been developed. *Model-Driven Engineering (MDE)* ideas have been applied to transform organizational models into ontologies derived from OntoiStar+.
2) It supports the automatic integration of enriched organizational models with general or domain ontologies [4]. To do this, semantic annotation suggestions [4] are the guidelines to annotate organizational models with concepts coming from ontologies. The *iStarML format* [1] has been extended with the attribute "*sannotation*" [5] to store semantic annotations for each model element.

2 The TAGOOn+ tool

The overview of TAGOOn+ is presented in Fig. 1. TAGOOn+ receives as inputs: *(i)* an organizational model M_1 expressed with i*, Tropos or Service-Oriented i* represented in the iStarML format. M_1 can be a semantically annotated model, i.e., a model annotated with concepts from a generic or domain ontology O_D [4, 5]; and *(ii)* the ontology O_D, required if M_1 has been semantically annotated with O_D. The outputs of the tool are: *(i)* an organizational ontology O_{iStar},

[1] TAGOOn+ is developed by INFOTEC-CENIDET-FBK. The current version 1.0 is downloadable under GPL license from the tool homepage http://tagoon.semanticbuilder.com

Fig. 2. A semantically annotated task element represented in OWL

Fig. 1. Overview of TAGOOn+ tool

which represents the knowledge described in M_1; *(ii)* an ontology O_{join}, which integrates O_{iStar} and O_D and represents the knowledge described in M_1 and O_D; and *(iii)* a text file T_{Doc}, that describe the O_{iStar} and O_D integration process. These ontologies are described in the standard *Web Ontology Language OWL.*

TAGOOn+ has been developed using the environment of the Eclipse project and the Java programming language. It runs on Windows, Linux and Mac.

The tool is based on three main modules:

Automatic Transformation module. This module implements a transformation process following MDE ideas. Therefore, the ontological metamodel *OntoiStar+* has been developed in order to integrate (into an ontology) the i*, Tropos and Service-oriented i* construct definition [3]. Moreover, transformation rules have been defined in [2] to transform a model M_1 into an O_{iStar} ontology. O_{iStar} corresponds to the ontology OntoiStar+ instantiated with individuals that represent the knowledge depicted in M_1, including semantic annotations [5].

We ilustrate the transformation process with a short example. Let's assume that we have an i* based model describing a *disease detection process* and an ontology O_D that describes diseases and the parts of the human body. A task element of the model labeled as *Revise esophagus* is annotated with the concepts *swallow, stomach and animal-organ* taken from O_D. This task in iStarML format is represented as: `<ielement id="01" name="Revise esophagus" type="task" sannotation="swallow stomach animal-organ"/>`. After applying the transformation process, the task corresponds to an individual of O_{iStar} (see Fig. 2).

Automatic Integration module. This module integrates a semantic annotated model M_1 represented as ontology O_{istar} with the ontology O_D used to annotate M_1. It parses O_D to obtain its hierarchical structure and the description of each concept. Then, each individual of O_{istar} is related with one or more concepts of O_D through links of type *is_a*. In this way, O_{istar} and O_D are integrated in O_{join}. O_{join} contains the knowledge included in the semantically annotated i* based model M_1 integrated with the knowledge included in the ontology O_D. Following with the example (Fig. 2), the O_{istar} individual *Revise esophagus* is related by *is_a* links with the concepts *swallow, stomach and animal-organ.*

Automatic Documentation module. This module generates a text file that describes the O_{istar} and O_D integration process.

A fragment of the generated documentation is: `type="task" name="Revise esophagus" annotation="swallow" description="To cause a bolus of food or drink to pass from the mouth/throat into the esophagus"`.

The semantic annotations are useful to discover hidden information. In the example, annotations add information to the task about the fact that the esophagus is used to swallow, and it is related with the stomach and it is an organ.

Using the Semantic Web Rule Language SWRL, we could generate a simple rule expressing that a person is related with two elements stomach and esophagus, and these element are related too. If this person has problems with its stomach, then is necessary to revise the esophagus. The rule in SWRL would then be: `Person(?x)` $\wedge$ `stomach(?y)` $\wedge$ `esophagus(?z)` $\wedge$ `hasRelation(?y,?z)` $\wedge$

`hasProblems(?x,?y)` → `hasRevise(?z)`. This rule is a short example applying reasoning over the organizational knowledge.

3 Conclusion

We have presented the tool TAGOOn+. With this tool, we bring the advantages of ontologies such as querying and reasoning, to the organizational modeling domain. Moreover, as the organizational knowledge is represented in *OWL*, it could be available to be exploited and consumed in the Semantic Web by paradigms such as Linked Data. On the other hand, we provide the integration of organizational models enriched with semantic annotations with ontologies, which makes organizational knowledge clearer for humans and more accessible to machines. Morever, we believe that a concept which integrates different model elements is a strong indicator to implement a new business services inside the organization, improving the understandability and expressiveness of an organizational model.

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