An Ontology-based Modeling Tool for Knowledge-intensive Services

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Abstract. The ATHENE modelling tool enables business people to create knowledge-intense process models without having to know the complexity of modelling ontologies. ATHENE is based on a three-level hierarchy of meta-meta, meta and object level. It allows business people to model business processes graphically meanwhile these processes are transformed internally into ontologies.

1 Objectives

Modelling business processes as ontologies is cumbersome and requires in-depth expertise of semantic technologies. However, business process modelling is a task mainly for business people who lack this expertise. So, the fundamental problem is that traversing from one sphere to the other requires manual labour in any of the two directions, i.e. both for querying and manipulation the process space [4]. To overcome this difficulties we developed a system called ATHENE for graphical modelling of business processes that are automatically transformed into ontologies. It corresponds to the theories of the Semantic Business Process Management as described by Hepp et. al. [4] which combines semantic web services (SWS) and Business Process Management (BPM).

From the user interface the modelling tool is equivalent to any other business process modelling tool. The business expert can model business processes in a familiar way. Internally, however, these models are represented as an ontology which results in a semantic representation of the process.

The idea of modelling in ATHENE is illustrated in figure 1. On the meta-level there is an ontology defining the concepts and properties for business process and service modelling. Examples of these ontologies could be OWL-S [6] or WSMO [8]. OWL-S for example contains concepts for

- atomic and composite services,
- control constructs like sequence, split+join, if-then-else, iteration, while, switch, ...[6]

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In our ATHENE modelling tool we define a graphical representation for each of these concepts. In addition, for each modelling object an interface is defined so that a user can specify properties. In our tool this interface is called “notebook”.

2 Meta-meta Modelling approach

Business process modelling, however, not only consists of modelling the processes themselves. In addition, there are other dimensions like organisational structure or data models for which there should be own model types, each consisting of ontology concepts with associated graphical representations.

To support the definition of new model types, our ATHENE system is based on a meta-meta-modelling approach, resulting in a three-level model hierarchy. The meta-meta level (also called meta^2-level) specifies the basic constructs for defining a model type, i.e. it predefines and allocates classes for the meta-level beneath.

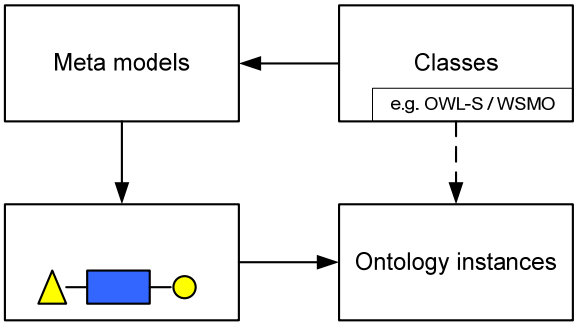

Fig. 1. The idea of modelling in ATHENE

The meta^2-modelling approach of ATHENE not only allows to easily define new model types but also to adapt the modelling environment for any kind of process modelling notations (e.g. BPMN), data models (e.g. ERM or UML), organisational structures or ontologies themselves. Thus, ATHENE can be regarded as a user-friendly graphical environment to model organizational structures which internally are represented as enterprise ontlologies, similar to the proposal of the TOVE Enterprise Modelling Project [8]. This offers a big flexibility as well as the possibility to adapt the modelling environment to a certain modelling notation. As ATHENE stores all information in a semantic manner and allows the modelling of any notation it is possible to generate Enterprise Models and combining different notations (e.g. process models, rulesets and ontologies). ATHENE could therefore be seen as first step towards SBPM as proposed by Hepp [4]. These combination options might also be a helpful for approaches like DEMO shown by Diez [3] where actors could be seen as organizational units connected with transactions.

3 The meta^2-level

The simple meta^2-model of Sinz [7] consists only of meta-object-types and meta-relations. There are three basic relations inside a meta^2-model: "is a", "has" and "connects". On the other hand, the Adonis modelling tool has a more complex, object-oriented meta^2-model [5]. For ATHENE we defined a meta^2-model that is generally based on the definitions of the meta^2-model of Sinz [7] but with useful extensions. Although, it does not have the complexity of the meta^2-model of Adonis as it has to be held more flexible.

4 Implementing meta^2-level

There are two different ways to implement meta^2-models. On one hand a meta^2-*model represented in a programming language* and on the other hand a *meta^2-model explicit expressed*. The former leads to an fixed meta-model where the adaptation is only possible via predefined model-, object- or attribute-types whereas the latter offers the possibility to create user-specific meta-models based on the definitions on the meta^2-level [2].

For ATHENE a meta^2-model which is expressed explicitly is much more suitable. Although, this kind of meta^2-model offers a bigger flexibility, it has to be considered that a meta^2-model that has been defined and used on meta-level cannot be changed at a later stage. This is due to the fact that meta-models are always based on a specific meta^2-model. A later change at the meta^2-model might lead to inconsistency and must therefore be prohibited.

But in spite of the theoretic complexity, one of the main goals is to make ATHENE user friendly what includes a way to easily create any kind of new meta-model on meta-level. The meta^2-level defines and allocates classes for the meta-levels beneath [1]. To realise this, the meta^2-model has to be comprehensive in knowledge covering.

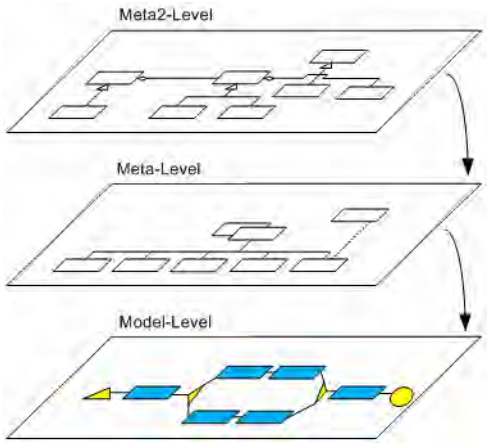

Fig. 2. The three-level-hierarchy

However, to put it in a nutshell, the tree-level-hierarchy works like this:

On top-level there is the meta^2-model. It defines the meta-object-types meta-relations and attributes represented as OWL classes. This meta^2 ontology defines guidelines for the meta layer. According to these definitions it is possible to define user-specific meta-models on the meta-level by specifying subclasses of the classes defined on the meta^2 ontology. In the end, concrete process models, data models or structures are modelled as instances of the classes of the meta language. *Figure 2* illustrates this architecture schematically.

5 The ATHENE system

ATHENE is implemented as web based application, what allows users to work in several places and share (meta-)models without exchanging files while no software has to be installed. Because of different strengths and advantages such as maturity, reliability, power and its similar behaviour in different browsers, Java Applet technology was applied.

To facilitate extensibility and optimize load time, ATHENE is built as a plug-in oriented framework where components (e.g. to define a model type) are loaded on demand. New components and subcomponents can be developed independently and made available in the base application through parameterisation.

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