# Putting Business Intelligence Into Documents

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Abstract. Business processes are often statically implemented and may not be established ad-hoc. For the realization of dynamic process configurations that demand for changes in these implementations static implementations are not suitable. In this paper we present our ideas on enabling dynamic business process implementations by reverting competencies in today's business processes, i.e. away from the system to the document that is processed. Our idea is to add semantics to business processes by modeling them as a facet of so-called Intelligent Content Objects. We present our ideas of mapping these task descriptions to current business process standards and the Web Service Modeling Ontology (WSMO) to make it useful in workflow execution environments like BPEL4WS and in Semantically Enhanced Service Oriented Architectures based on Semantic Web Services (SWS).

# 1 Introduction

The intention of Business Process Management (BPM) is to manage the execution of business processes based on a business expert's view. Several drawbacks exist for mediating between these experts' views and the resulting implementations which could be resolved by applying semantics to BPM which is already shown in [5]. In [5] is shown that besides other reasons the lack of machine-readable representations is a major obstacle towards mechanization of BPM. An additional technical obstacle for porting document centric processes between different systems could be overcome by bundling process descriptions with documents which are going to be processed, ie. to apply Intelligent Content Objects which include formal descriptions of their included content and declarative process descriptions. These descriptions may capture an ontological representation of the expert's view which enables its conversion to BEPL4WS and the Web Service Modeling Ontology (WSMO). This conversion would make our approach compatible with the proposal of Semantic Business Process Management (SBPM) by Hepp et al. [5].

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# 2 The Role of Intelligent Content Objects in SBPM

## 2.1 Intelligent Content

The term Intelligent Content (IC) is a notation for content containing information with explicit semantic descriptions of its properties. Intelligent Content Models as previously assessed for example in [2], can be seen as a carrier for semantically rich information goods which include all the information that is needed to deal with the content in specific situations: Imagine for example a scenario where a contract goes through several validations, additions, modifications and other operations from various people in the course of a workflow. This contract, included content, and the description of the workflow we see as parts of an IC Object. Having the contract together with descriptions of its associated processes is useful when the content is processed in foreign systems which are not knowing how to deal with the content or how to query its properties beforehand. To apply IC Objects in SBPM frameworks is especially useful for content procurement and billing processes. What is essential for making IC Models useful in BPM however, are task and process descriptions available in a declarative and formal form. We intend to follow the KCO approach [1] which includes such descriptions based on the DOLCE Plans and Tasks Ontology (DDPO)<sup>3</sup> [4].

# 2.2 KCO – A Model for Intelligent Content

Knowledge Content Objects (KCOs) are based on the DOLCE foundational ontology<sup>4</sup> and have so-called semantic facets that form modular entities to describe the properties of KCOs, including the raw content object, metadata and knowledge specific to the content object and about the subject matter of the content. In addition to this knowledge structure the KCO defines a structure based on the different domains of the knowledge objects. This structure is divided into six so-called *facets*, each of them optimized for a specific usage (see [1] for details):

- 1. **Content Description** includes access information, meta data schemes and subject matter knowledge
- 2. **Presentation Description** describes how the content (and the knowledge) of the KCO is presented to users and specifies modes of interaction
- 3. Community Description contains descriptions of plans, tasks, roles and goals in the context of a community, and a list of actions performed during the content lifecycle.
- 4. **Business Description** specifies how to trade the content, including the specification of business models and negotiation protocols.
- 5. **Trust and Security** specifies methods that ensure security and trust for KCO users

<sup>4</sup> http://www.loa-cnr.it/DOLCE.html

<sup>&</sup>lt;sup>3</sup> DDPO is an extension of DOLCE (Descriptive Ontology for Linguistic and Cognitive Engineering), DnS (Ontology of Descriptions and Situations), and Plans Ontologies.

Self-description declares the structure of the KCO itself, including active facets, ontologies used, etc.

The use of foundational ontologies in KCOs establishes a minimal but shareable model for content interoperability between heterogeneous applications. In particular they are the basis for a common understanding of the structure of information, enable the reuse of domain knowledge, make assumptions explicit and enable to separate domain knowledge from operational knowledge.

## 2.3 Application of KCOs in SBPM

The main intention of SBPM is to increase the level of automation in BPM by representing the various spheres of an enterprise using ontology languages and Semantic Web Service Frameworks [5]. The authors of [5] aim to (1) semantically represent and describe processes, (2) to ontologically capture the IT landscape and domain knowledge, (3) to create a semantic integration layer for transactional data, (4) to perform semantic search on processes, data, and resources, and (4) to use SWS execution environments for the mediation between business goals and business expert's needs. The intention of KCOs – as introduced in section 2.2 – is also to model parts of the process space of BPM using foundational ontologies: (1) User Tasks in the context of a community that use KCOs (in its community facet), (2) User roles in the particular community (in its community facet), and (3) negotiation protocols and pricing schemes for content negotiation (in its business description facet).

To apply IC Objects in SBPM systems like the one proposed in [5], a mapping from DPPO to WSMO is needed in order to enable the execution of plans modeled in the business facet of a KCO. This mapping is conceptually possibly as it was shown indirectly in [7] where an alignment of OWL-S to DOLCE is reported and by Scicluna et. al in [8] who map OWL-S to WSMO. We intend to combine these two approaches to implement a declarative mapping layer which then shall enable the execution of business processes associated with a KCO.

## 2.4 Expected Benefits

KCOs are a tool to capture and model essential knowledge about a particular entitiy or situation (the "knowledge") in one place and they can be used to transfer this knowledge and content between heterogeneous systems. But introducing KCOs in SBPM frameworks is not only useful when transferring them between different applications: They can also be seen as a communication tool, ie. they may capture a problem in a domain and the possible solutions and processes available for that problem. This information can be visualized (using information in the presentation facet) to increase knowledge transfer.

## 2.5 Related Work

The TOVE project has developed a set of ontologies for describing various aspects of an enterprise [3] and Hepp et. al introduce an ontology infrastructure

for SBPM in [6]. The ontologies used in the KCO are related to the ones in [3, 6], as they are used to model basic notions of processes, activities, particulars and their roles (which are part of the Upper Process Ontology, Upper Organizational Ontology, Business Functions Upper Ontology in [6]). There a three levels of KCOs: generic, domain, and application level KCOs. The foundational ontologies used for (a generic-level) KCOs are intended to be refined to develop specific domain and application ontologies like the Business Organization Ontology in [6] for domain- and application-level KCOs.

## 3 Conclusions and Future Work

In this position paper we provided arguments for the usefulness of Intelligent Content Objects in Semantic Business Process Management (SBPM). They provide a minimal shareable model for content interoperability between heterogeneous systems and enhance the transfer of business knowledge and content between them. Future work includes the realization of the mapping between DDPO and WSMO in the project GRISINO<sup>5</sup> whose goal is to demonstrate the usefulness of the combination of Intelligent Content and Semantic Web Services.

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<sup>&</sup>lt;sup>5</sup> http://www.grisino.at