Business Modeling Using Ontologies

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Abstract

Business Modeling has become more popular in the recent years. The idea behind this concept is to represent every aspect of a business, by creating models that are effective in problem solving, that ease the communication with customers and allow the company to stay competitive in e-business. Business success nowadays means to introduce innovations of information technology. The relation between these two domains is essential for a business to make better decisions, to improve marketing and to offer better customer support. Through information technology, businesses can use real time monitoring and virtual reality in order to detect many problems in the overall business performance. In this paper, we discuss about business modeling concepts, web semantics technologies and the benefits of using ontologies to model business domain and improve business processes. Finally, we propose a case study in which we can convert BPMN schemas in business process ontology.

1. Introduction

A business model is a simple representation of the complex reality of a business. The primary purpose of a business model is to communicate something about the business to other people: employees, customers, partners, or suppliers [BZ+09]. A business model is necessary because it captures business goals and shows efficiently how to achieve these goals. Building a business model also encourage executives to see another perspective of what is significant to customers and how to best deliver services or products to them.

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to make better decisions, to improve marketing and to offer better customer support. As discussed by [OPP+04] Information and Communication Technology (ICT) has increased the number of possible business configurations a company can adopt. In other words, firms can increasingly work in partnerships, offer joint value propositions, build-up multi-channel and multi-owned distribution networks and profit from diversified and shared revenue streams. According to this we can say that the number of actors participating in business tends to increase, and it is clear that we need a better understanding of the relationships that exist between different actors and different channels, also to determine their role in business processes and workflow.

The use of ontologies when modeling a business creates a complete view of all business components and adds reasoning skills by enabling tracking of problems that may occur in different business activities. In the simplest case [GUA98], an ontology describes a hierarchy of concepts related by subsumption relationships; in more sophisticated cases, suitable axioms are added in order to express other relationships between concepts and to constrain their intended interpretation.

As discussed by [ILA+07] the ontologies related to business developed in two branches: one is called enterprise ontologies and the other describes the concepts related to business transactions. In this paper we discuss the benefits of modeling a business in general and we focus more on the use of ontologies especially in business domain and the relation between BPMN[1] and ontologies.

2. Previous Work

There are many solutions and researches regarding the use of web semantics and ontologies to model business activities and processes. In dissertation [OST+04] discussed about the need to have a rigorous model describing the concepts of a business model,

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[1] Business Process Model and Notation

thus by building a business model ontology (BMO) he is building on existing knowledge of the domain the ontology describes the terms, elements, attributes and relationships of the business model concept. The ontology has been applied in a real life case study MJF in order to see the ontology's applicability to a real-world. Also a BM2L language is built which in combination with the off-the-shelf XML tool xmlspy is comparable to a CASE tool.

Another ontology is REA (Resource-Event-Actor) designed firstly by [McC82]. The main concepts in the REA ontology are Resource, Event, and Actor. In their study REA model can be used in the design of complex object accounting system by addressing and solving different issues like proper balance between the declarative and procedural features of an accounting database.

In [GAV+00] they propose an e3-value ontology in a number of industrial e-business development projects. The main concepts in e3-value are actors, value objects, value ports, value interfaces, value activities and value exchanges. They argue that an e-business model and a process model differ in a number of ways, i.e. the concepts in e-business modeling are centered around the notion of value, while in process modeling concepts focus on how a process should be carried out in operational terms or in an e-business model, an actor adds value, while in a process model an actor performs an operational process.

In [ABEI+06] have presented a common ontology based on three business ontologies the e3 -value, REA and BMO. They constructed the common ontology primarily in order to gain a better understanding of the original ontologies. The work has shown that there is a considerable overlap between these three ontologies but that there are also differences, some obvious and some subtle. They have modeled a number of business scenarios using the common ontology and by doing so discovered differences between concepts in the original ontologies that at first might have been seen as identical. As mentioned above, the use of ontologies can be applied in every area not only in business. Of particular interest is the modeling of government services [SHXH18] using ontologies. Since the economy sector is of major importance to the government, the application of business models based on ontology leads to benefits in terms of economic prosperity.

3. BPMN and Ontology

BPMN is a standard notation used by businesses as a common graphical language for modeling business processes. Visualization through diagrams enables diverse business users to easily understand business activities and processes. Business analysts need a standard notation to design business processes, in the same way business users require the same standard to manage and observe this processes. BPMN provides a set of elements *Figure 1*, which have different shapes and specific meaning. These elements are simple and intuitive and can be used for different types of diagrams like process diagram, choreography diagram or conversation diagram.
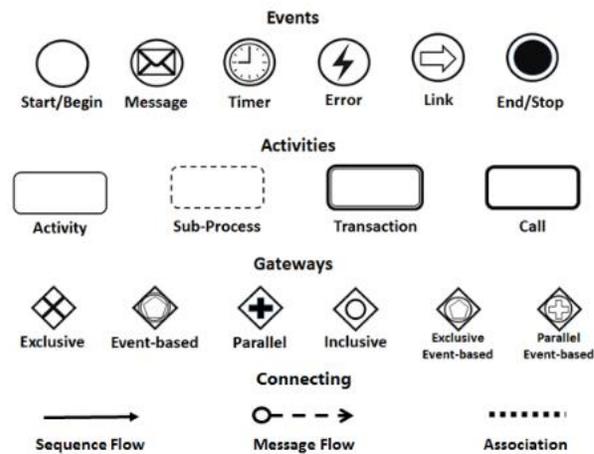

Figure 1. Samples of the BPMN diagramming symbols (Source: https://study.com/academy/lesson/business-process-model-and-notation-process-examples.html)

As explained in BPMN specification [OMG10] these elements reside in five basic categories:
1. Flow Objects
2. Data
3. Connecting Objects
4. Swimlanes
5. Artifacts

Flow Objects are the main graphical elements to define the behavior of a Business Process. There are three Flow Objects: Events, Activities, and Gateways.

A traditional requirement of Process modeling is to be able to model the items (physical or information items) this is realized with data elements that are created, manipulated, and used during the execution of a Process. Data is represented with the four elements: Data Objects, Data Inputs, Data Outputs, Data Stores.

To connect Flow Objects to each other or other information, four Connecting Objects are used: Sequence Flows, Message Flows, Associations, and Data Associations.

There are two ways of grouping the primary modeling elements through "Swimlanes:"

1. Pools
2. Lanes

Artifacts are used to provide additional information about the Process. There are two standardized Artifacts, but modelers or modeling tools are free to add as many Artifacts as necessary. There could be additional BPMN efforts to standardize a larger set of Artifacts for general use or for vertical markets. The current set of Artifacts includes: Group and Text Annotation. More detailed information about the categories and each element symbol are given in the BPMN specification [OMG10].

3.1 Case study from BPMN process to Ontology

In previous versions of BPMN it was relatively difficult to exchange BPMN models. In BPMN 2.0 the specification defines a standardized exchange format. This standard is supported by many tools vendors [ALLW16], so now we can easily exchange BPMN models not only between different modeling tools but also between a modeling tool and a BPMS[2].

Since every business process can be explained with BPMN standard and it also offers now a way to create platform-independent exchange of BPMN 2.0 diagrams by generating XML file formats we can easily propose an idea of enriching BPMN process diagrams with semantics. As defined by [AGHH12], in general, an ontology describes formally a domain of discourse. Typically, an ontology consists of a finite list of terms and the relationships between these terms. The terms denote important concepts (classes of objects) of the domain. For example, in business

domain: activities, customers, suppliers, cost structure, market, channels are some important concepts.

Every element in BPMN Specification can be transformed in a class in ontology and the relations between elements can also be converted to relations between objects and classes in ontology. If we have a BPMN business process diagram we would like to add additional information for a task or an event. Another relevant issue is to be able to retrieve additional information i.e. knowing if an activity performs better, when the process is designed with a specific event like message or time. Therefore by using semantic knowledge we can query the designed ontology based on BPMN and get the desired results. Queries in ontology are performed by using SPARQL[3], SPARQL stands for (SPARQL Protocol and RDF Query Language) it can be used to express queries across diverse data sources. As discussed by [NAT11] the BPMN 2.0 specification [OMG10] provides a metamodel for BPMN elements as a UML class diagram and in the form of an XML schema. So based on metamodel for BPMN elements as a UML class diagram *Figure 2* the ontology can be easily converted in classes and attributes and relationships between them.
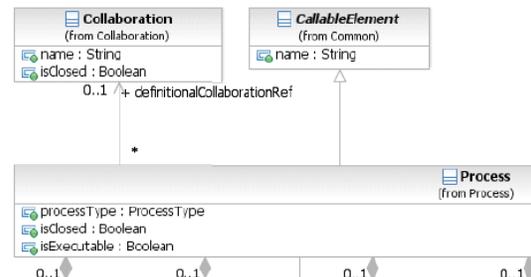

Figure 2. Process Details Class Diagram (Source: http://www.omg.org/spec/BPMN/2.0)

For example in our ontology we can declare a class Process which might have attributes like Public or Private, we can than declare a subclass FlowElement and for FlowElement another subclass Activity. Another class in relation with the Process would be ResourceRole. The individuals in this class are specific due to the role of different resources involved in the

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process. So we can compose the manual conversion of all classes and their attributes defined in the process class diagram and other diagrams as that of the activity, but an automatic solution would facilitate this procedure. The figure below proposes the steps that would convert from bpmn to xml and ontology formats.
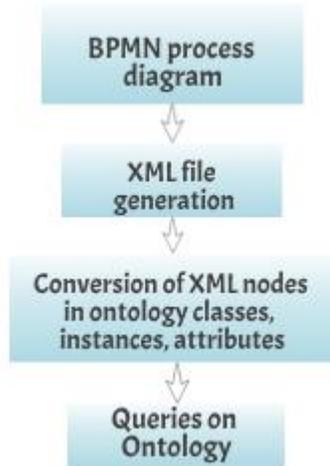

Figure 3. Steps from BPMN to Ontology

4. Conclusions and Future Work

In this paper we discussed about the value of modeling a business and how business processes can affect business problem solving, customer communication and the overall business performance. By using BPMN standard notation for modeling business processes, different business users can easily understand business activities and processes. In BPMN 2.0 the specification defines a standardized exchange format so most of the tools can successfully generate BPMN diagrams in XML file formats even though some of them lose some information during the process. This approach allows retrieving information from xml which can be converted in ontology.

In web semantics technologies we have the possibility to query in order to retrieve additional information i.e. knowing if an activity performs better, when the business process is designed with a specific event. Also we can add additional information to explain better tasks or events. This will allow searching more accurately by keywords or notes. As our future

work, we plan to develop a prototype based on the case study above to convert from BPMN process diagrams to ontology in order to easily exchange information between them.

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