Chapter 9
Automated Planning of Process Models:
Towards a Semantic-Based Approach

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ABSTRACT

Companies need to adapt their processes quickly in order to react to changing customer demands or new regulations, for example. Process models are an appropriate means to support process setup but currently the (re)design of process models is a time-consuming manual task. Semantic Business Process Management, in combination with planning approaches, can alleviate this drawback. This means that the workload of (manual) process modeling could be reduced by constructing models in an automated way. Since existing, traditional planning algorithms show drawbacks for the application in Semantic Business Process Management, we introduce a novel approach that is suitable especially for the Semantic-based Planning of process models. In this chapter, we focus on the semantic reasoning, which is necessary in order to construct control structures, such as decision nodes, which are vital elements of process models. We illustrate our approach by a running example taken from the financial services domain. Moreover, we demonstrate its applicability by a prototype and provide some insights into the evaluation of our approach.

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INTRODUCTION

In times of dynamically shifting markets, companies, especially those integrated in electronic supply chains, have to adapt or even restructure their processes frequently. First, regarding the sales market of a company, changing customer needs and new offers of emerging competitors need to be considered and demand for quick reactions in the form of enhanced services and innovative products. Second, a national and international network of business partners gets more and more important in order to be able to offer best-of-breed-products and customized solutions instead of commodities. Such approaches, along with an efficient design of the supply chain, constitute distinguishing factors between competitors. Third, the market of suppliers for a company, especially of IT suppliers, is expanding. Only ten years ago, the share of proprietary and individual software has been considerably higher than today. In the future, it should be possible to design and modify company specific applications by composing Web Services provided by external software suppliers according to predefined business processes. In any of these three "market views" processes constitute the starting point for dynamic modifications along the value chain.

In order to counter the above mentioned requirements of a dynamic and flexible (re)design, traditional techniques and tools for process modeling and optimization seem to be insufficient or inadequate to some extent. Reasons are that traditional modeling techniques for process (re) design imply a significant degree of manual work (e.g. Becker & Kahn, 2003; Borges et al., 2005; Ma & Leymann, 2008) or result repeatedly in a high demand for communication and clarification because of different terminologies (Becker et al., 2000; Thomas & Fellmann, 2006).

According to the ongoing research in the area of Semantic Business Process Management (SBPM), a higher degree of automation concerning the use of process models can contribute to a solution (cf. Hepp et al., 2005; Thomas & Fellmann, 2006). More precisely, we envision the automated design of process models. As this task can be regarded as a kind of planning problem (cf. Ghallab et al., 2004; Henneberger et al., 2008; Heinrich et al., 2009), we speak of an automated planning of process models. One basis for the automated planning of process models constitute Semantic Web standards like the Web Ontology Language (OWL) that enables a semantically enriched description of process models and their elements (e.g. Betz et al., 2006; Drumm et al., 2006). These standards have already been used for Semantic Web Service Composition. Yet, in contrast to Semantic Web Service Composition approaches, the planning of process models is conducted on a conceptual level independent from the underlying technology. The composition of Web Services is accomplished for a specific problem, that means a number of Web Services is arranged together to deliver one distinct and previously defined output. For the planning of process models, however, we abstract from one individual process execution and its implementation. Thus, process models are initially technology independent and may partially be realized by different combinations of available Web Services (from different providers) that may be chosen afterwards by means of economic aspects like cost and risk. This two-step approach is advantageous as it increases flexibility and bears optimization potential. It is moreover reasonable to assume that the step from descriptions of process models and process actions to concrete implementations using Web Services is relatively small (e.g. Drumm et al., 2006).

Yet, the automated planning of process models – in the sense of an automated design of entire new process models – is hardly discussed in the scope of SBPM, if at all. Doubtlessly the conceptual and technological basis for an automated planning of process models is to a certain extent already present in the areas of Artificial Intelligence (AI) planning and Semantic Web Service Composition. Several approaches in both domains indeed exist, but the