An Agent-Mediated Platform for Business Processes

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ABSTRACT

Business processes have been widely becoming crucial assets of organisations across various industries and domains. The flexibility in dealing with changes when business processes are executed has significant impact on the success of an organisation’s business operations, especially in the current ever-changing business environment. In this context, agent-based systems offer a promisingly powerful platform for business process execution. In this paper, the authors propose an agent-mediated platform for business processes with the aim to contribute to bridge the gap between business process management and agent-oriented development. They present a conceptual mapping method for a seamless transition from business process models in Business Process Modelling Notation (BPMN) to agent-oriented models in the Prometheus methodology, which is implemented using the ATLAS Transformation Language. The authors also developed an Eclipse-based plug-in which allows the designer to import BPMN models into the Eclipse-based Prometheus Design Tool.

Keywords: Agent-Oriented Software Engineering, Business Process Design, Business Process Execution, Business Process Management, Multi-Agent Systems

1. INTRODUCTION

A business process is defined as consisting of a set of activities, performed by their relevant roles or collaborators, to intentionally achieve the common business goals (Smith & Fingar, 2003). Business processes are the core assets of any enterprise since they generate revenue and often represent a significant proportion of costs. A recent study (Hill, Cantara, Deiter, & Kerremans, 2007) has shown that the business process management (BPM) software market reached nearly $1.7 billion in total software revenue in 2006 and this number continues to grow. The flexibility and reactivity in process execution through IT-systems have significant impact on the success of an organisation’s business operations, especially in the current constantly changing business environment. Existing BPM systems, which require a priori representation of a business process and all potential deviations from that process, however, do not provide adequate support.

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to achieve these requirements in a satisfactory way (Burmeister, Arnold, Copaciu, & Rimassa, 2008; Fingar, 2008).

A software agent (Wooldridge, 2002) is a piece of software which is situated in an environment, autonomous (i.e. acts on its own), social (interacts with other similar entities), and being reactive (responding to changes in its environment) and/or being proactive (working to achieve its goals). Multi-Agent systems (MAS) provide powerful and flexible execution platform for business processes. On such a platform, the executing process is able to pursue persistent goals over time despite previously failed attempts due to the availability of multiple ways of dealing with a given goal, as in the Beliefs-Desires-Intentions (BDI) platform (Rao & Georgeff, 1995). The agent view also provides an intuitive, well-suited level of abstraction for modelling and implementing process execution. For instance, a process participant can be explicitly represented as an agent at the execution level, which reflects more accurately the structure of an organisation. Existing process execution platforms such as the Business Process Execution Language\(^1\) (BPEL) do not capture such structural information at the business level (Endert, Küster, Hirsch, & Albayrak, 2007).

Since the late 1980s, the field of agent technology has attracted a substantial amount of interest from researchers (Jennings, Sycara, & Wooldridge, 1998; Luck, McBurney, Shehory, & Willmott, 2005). In particular, there have been a number of different agent theories, architectures, and languages proposed in the literature. Agent technology, however, still faces many challenges in being adopted by the industry despite its popularity and attractiveness as a research area (Weyns, Parunak, & Shehory, 2009). Therefore, closing the gap between the business community, BPM in particular, and agent technology can bring substantial benefits to both sides: agents gaining better industry traction whilst BPM having a powerful solution to deal with its current challenges (Ghose, 2009).

Although it is possible to execute business processes with traditional business process management systems, the use of MAS for implementation of business processes offers several key advantages. Business processes tend to be initially designed in such a high-level, abstract manner which does not provide in depth understanding of the process and its ability to achieve desired goals. Such processes usually capture only the normal/main behaviour and tend to miss out on exceptional alternatives. We believe that translating business process models to an agent-based platform would provide a mediation facility to help business process designers explore alternative flows in the process. Therefore, in this paper our focus is on proposing a mapping between business process models specified in Business Process Modelling Notation\(^2\) (BPMN) to concepts and artifacts of the Prometheus agent-oriented methodology (Padgham & Winikoff, 2004). We have chosen BPMN since it is a standard for business process modelling and has been widely used and supported in numerous modelling tools. The choice of Prometheus is due to various reasons: its wide use in both industrial and academic settings, considerable detailed support for most of the software engineering development phases, and the availability of tool support, Prometheus Design Tool\(^1\) (PDT). We take the model transformation approach and implemented the mapping using Atlas Transformation Language (Jouault, Allilaire, Bezivin, & Kurtev, 2008). This transformation forms the main part of an Eclipse-based plug-in that we have developed for PDT to allow the designer to import BPMN models.

The organization of this paper is as follow. In section 2, we provide a brief description of BPMN and the Prometheus methodology. We then discuss our approach to transform BPMN models to Prometheus models in section 3. Section 4 provides a description of a plug-in for Prometheus Design Tool that supports the transformation. Related work is presented in section 5. Finally, we conclude and discuss some directions for our future work in section 6.
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