
Preface: integrating business processes and services

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1 Introduction

Service-Oriented Computing (SOC) is an emerging paradigm for integrating software applications within and across organisational boundaries. In this paradigm, independently developed and operated applications are exposed as web services that are then interconnected using a stack of web-based standards including SOAP, WSDL, WS-Addressing, WS-Security, etc. (Weerawarana et al., 2005). While the technology for developing basic services and interconnecting them on a point-to-point basis has attained a certain level of maturity and adoption, there are still many open challenges when it comes to managing interactions with complex services or managing interactions involving large numbers of services.

Business Process Management (BPM) is another emerging systems integration and management paradigm that aims at achieving alignment between business requirements and technology capabilities. BPM has been defined as a set of "methods, techniques, and tools to support the design, enactment, management, and analysis of operational business processes" (van der Aalst et al., 2003). A *process* in turn can be defined as a "a set of [...] activities carried out to attain some goals. These activities are structured within a partial order such that some activities may be required to precede others. Each activity may have many attributes (e.g. input data, persons performing activity, time constraints) [...] and may span a spectrum from totally manual to totally automated execution." (Ellis et al., 2005). BPM has been the subject of intensive study for the past

years and has inherited a significant body of knowledge from previous related research and development streams, including business process reengineering and workflow management.

There exist strong links and potential synergies between BPM and SOC. On the one hand, BPM may rely on SOC as a paradigm for managing resources (especially software ones), describing process activities or capturing the interactions between a process and its environment. On the other hand, a service may serve as an entry point to an underlying business process, thereby inducing an inherent relation between the service model and the process model. Also, services may engage in interactions with other services in the context of the execution of a business process.

This Special Issue gathers five contributions that integrate concepts and techniques from BPM and SOC in different manners. These contributions are extended and revised versions of papers presented at three workshops held in conjunction with the Third International Conference on Business Process Management (BPM'2005):

- Workshop on Business Processes and Services
- Workshop on Web Services Choreography and Orchestration for Business Process Management and
- First International Workshop on Business Process Intelligence.

The first two papers relate to a highly topical research problem in the area of SOC, namely the management and optimisation of Quality of Service (QoS). The first paper 'Dynamic Web Service Composition with QoS Constraints' by Danilo Ardagna and Barbara Pernici presents a process-driven approach to predict and optimise the QoS of web services that rely on other web services to execute certain operations. Their proposal reuses techniques from operations research (mixed integer programming) to associate web services to activities in a process in a way that maximises the overall QoS. The second paper 'A Search Engine for QoS-enabled Discovery of Semantic web Services' by Le-Hung Vu et al. provides a complementary perspective. It proposes an approach for semantically describing the QoS of web services and providing a scalable search engine to discover web services based on QoS requirements. The framework supports feedback from users and rating agencies to converge to an accurate picture of the actually provided QoS and includes a statistically robust trust and reputation model to prohibit attacks such as bad-mouthing or colluding users to push the QoS of a service.

Next, this paper 'Discovering web service Workflows Using Web Services Interaction Mining' by Schahram Dustdar and Robert Gombotz, discusses the possibility of reverse-engineering the process models implemented by one or several web services by analysing their interactions as recorded in message logs. In particular, the paper investigates

the applicability of web session identification techniques to the problem of grouping raw message logs into 'process execution traces', so that these traces can be given as input to process mining algorithms.

The fourth and fifth papers consider the use of Abstract State Machines to formally capture and analyse service-oriented business processes. The paper 'A High-Level Specification for Virtual Providers' by Michael Altenhofen et al. defines a mathematical model to analyse so-called 'virtual providers': mediators that can reconcile mismatches between the interaction process natively implemented by a service and the interaction process that this service is expected or required to provide in a given context. This formalisation is extensible: it starts from a very abstract definition of Send and Receive primitives that can be refined to account for different types of mismatches. Finally, in the paper 'An Abstract Machine Architecture for web Service-based Business Process Management', Farahbod et al. provides a formal semantics of a proposed standard for describing service-oriented business processes, namely the Business Process Execution Language for web services (BPEL). This formalisation is an important step in identifying areas where this proposed standard could be made less ambiguous. It also provides a potential basis for analysing properties of BPEL processes in a rigorous manner.

This issue also includes a regular paper titled 'Pi Calculus based bitransformation of State-driven Model and Flow-driven Model' by Ke Xu et al. This paper lays down a formal foundation for translating between state-based process modelling paradigms, such as statechart diagrams, and flow-based paradigms, such as activity diagrams. This paper demonstrates a semantic equivalence between these paradigms and argues that these paradigms should be seen as complementary viewpoints.

We believe this selection of papers covers a wide range of open research questions related to the integration of BPM and SOC. We hope they will be an inspirational source of further research in this domain.

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