Chapter 6.6
Empowering Web Service Search with Business Know-How:
Application to Scientific Workflows

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ABSTRACT

Scientists who are not proficient in computer science and yet wish to perform in-silico experiments and harness the power of Service Oriented Architecture are presented with dozens of daunting technical solutions: scientific workflow frameworks. While these systems do take care of complex technical aspects such as Grid technologies, little is done to support transfer of service composition knowledge and know-how. The authors of this chapter believe the problem lies in the scientific workflow models which are too low-level and too anchored in the underlying technologies to allow efficient reuse and sharing. This chapter's approach, called SATIS, relies on a goal-driven model, that has proven its worth in requirement engineering, and the Semantic Web technologies to leverage the collective knowledge and know-how in order to bridge the gap between service providers and end-users.

INTRODUCTION

Service Oriented Computing (SOC) is a computing paradigm using and providing services to support the rapid and scalable development of distributed applications in heterogeneous environments. Despite its growing acceptance, we argue that it is difficult for business people to fully benefit of SOC if it remains at the software level. This is especially true for scientists looking for web services to operationalize scientific workflows. We claim it is required to move towards a description of services in business terms, i.e. intentions and strategies to achieve them and to organize their

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publication and combination on the basis of these descriptions.

Moreover, service providers and users still face many significant challenges introduced by the dynamism of software service environments and requirements. This requires new concepts, methods, models, and technologies along with flexible and adaptive infrastructure for services developments and management in order to facilitate the on-demand integration of services across different platforms and organizations. Users exploit their domain expertise and rely on previous experiences to identify relevant services to fulfill new requirements. Indeed, they develop know-how in solving software related problems (or requirements). And we claim it is required to turn this know-how into reusable guidelines or best practices and to provide means to support its capitalization, dissemination and management inside user communities.

The ability to support adequacy between service user needs and service providers' proposals is a critical factor for achieving interoperability in distributed applications in heterogeneous environments. Service final users need means to transmit their functional and non functional requirements to service designers, especially when no service is available. And service designers need means to disseminate information about available services in order to improve their acceptance by users as well as means to better handle the way final non computer scientist users combine services to fulfill their goals. Reasoning about high-level descriptions of services and know-how about final users services combination help to support bidirectional collaboration between non computer scientist users (service final users) and computer scientists (service designers).

So, from a general point of view, software engineering implies a growing need for knowledge engineering to support all aspects of software development. In this chapter, we focus on knowledge engineering to support service combination from a user perspective. And we focus on scientist needs when operationalizing scientific workflows.

We propose a framework, called SATIS, *Semantically AnnotaTed Intentions for Services* (Isabelle Mirbel & Crescenzo, 2009), to capture and organize know-how about Web Services combination. Therefore we adopt Web semantic languages and models as a unified framework to deal with user requirements, know-how about service combination as well as Web Services descriptions. Indeed, we distinguish between intentional and operational know-how. Intentional know-how captures the different goals and subgoals the final users try to reach during his/her combination task. Intentional know-how is specified with the help of an intentional process model (Rolland, 2007). Operational know-how captures the way intentional sub-goals are operationalized by available suitable Web Services. Operational know-how is formalized as queries over Web Service descriptions.

In SATIS, users requirements, know-how about service combination as well as Web Services descriptions are resources indexed by semantic annotations (Martin et al., 2004; Ora Lassila & Ralph R. Swick, 1998; T. Version, L. Version, P. Version, & McBride, 2004) in order to explicit and formalize their informative content. Semantic annotations are stored into a dedicated memory. And information retrieval inside this memory relies on the formal manipulation of these annotations and is guided by ontologies.

Annotations of intentional and operational know-how are respectively stored as abstract and concrete rules implemented as SPARQL construct queries. When considered recursively, a set of SPARQL construct queries can be seen as a set of rules processed in backward chaining. As a result, someone looking for solutions to operationalize a business process (in our case scientific workflow) will take advantage of all the rules and all the Web Service descriptions stored in the semantic community memory at the time of his/her search. This memory may evolve over the time and therefore

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