Chapter 2.1
A Survey of Development Methods for Semantic Web Service Systems

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ABSTRACT

Semantic web services (SWS) hold the promise of enabling dynamic discovery of candidate web services fitting a particular specified need. One interesting question is what impact this will have on software and systems engineering methods – will mainstream methods like RUP still be suitable, or will new or adapted methods be needed? This article surveys the state-of-the-art in methods specifically tailored for the engineering of SWS systems, looking at development methods trying to cover the entire lifecycle as well as methods covering only one or two phases. Some of the surveyed methods are specifically meant to deal with semantics, others are for the engineering of service-oriented systems in general. The survey reveals that there are many proposals being made in this area, some extensions of mainstream methods like RUP, others more experimental.

INTRODUCTION

During recent years, the software industry has increasingly acknowledged that using discrete building blocks of software provides an effective way of engineering such systems (Stojanovic & Dahanayake, 2005). The 1990's saw an increased use of component based development (CBD), but this is now giving way to the increasingly popular technologies of Web Services and Service Oriented Architectures (SOA) (Stojanovic & Dahanayake, 2005). In the future, Semantic Web Services (SWS) may provide an even more powerful way of rapidly building flexible and advanced Service Oriented Systems (SOS).

Technology versus Development Methods

When information systems are developed based on some specific technology, this implies the use of some underlying basic concepts such as *ser-*

vice, *requester*, and *provider,* and a certain way of thinking about the structure and organization of the information systems. Hence, it is important that the system engineering methods match the underlying technology, to be able to create systems of high quality in a more effective manner. To effectively develop or adapt methods for engineering of SWS systems, there is a need for understanding what special concerns arise when engineering these systems. New engineering methods or adaptations of general methods may be desirable if special concerns are to be taken into consideration.

The service concept elevates the abstraction level and aims at empowering business users to create and execute software systems based on SOA (Erl, 2005; Stojanovic *et al.*, 2004). Many technology standards for SOS and Web Services-systems have emerged, but little attention has been given to methods for modeling and designing such systems (Cabral *et al.*, 2004). The amount of new technology is growing and it changes over time, making development complex and error-prone. As a result, increased application adaptability, widespread reuse and commercialization is slowed without proper support from methods and development tools (Cabral et al., 2004).

Motivation and Purpose

This article surveys the current state-of-the-art in engineering methods specifically tailored for the requirements specification, modeling, design and development of SWS systems. Methods may also be in the form of specially designed tools for supporting the development of SWS systems. The motivation for providing such a survey in terms of its utility for the reader is as follows:

- Giving an overview of methodological differences that have been envisioned between SWS systems development and current mainstream software development.

- Giving an overview of, and some comparison of, different methods and techniques that have been proposed to deal with the specific challenges of developing SWS systems, so that the reader can more easily navigate the plethora of existing proposals and possibly find a method which is useful in the reader's own context (whether this be research or practice).

We try to analyze what makes the development of SWS systems different and unique compared to the development of other kinds of information systems. From the survey we also try to identify what special concerns the methods take into consideration, and compare these concerns in the analysis. We perform a simple classification and comparison of the different methods and tools. In the end, we identify some suggested areas for future research into methods and tools supporting the engineering of SWS-based systems.

Scope

This article focuses on requirements specification, modeling, design / development, and testing / evaluation methods for creating SWS-based systems for end-users. It does not focus on methods for developing new technologies or frameworks for such systems, but rather attempts to look at what becomes important if assuming that the proper technical infrastructure is in place. As a result, we are focused on methods that involve users, with more or less technical skills, to see what systematic approach, actions, processes and tools are required to create a system for end-users based on an existing infrastructure framework.

Engineering of SWS systems may be seen from two perspectives: Engineering of individual SWS (as a service provider), or engineering of SOS utilizing SWS (SWS-based systems, as a service requester). When building the latter kinds of systems, there is often a need for simultaneously developing services - not only utilizing existing

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