
A Semantic Contract Model and Knowledge-driven Process for Supporting Controllability in Service-oriented Approaches

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Abstract

Service-oriented paradigms have dramatically changed the way of providing applications and doing businesses. Both SOA and the Cloud have enabled the creation of new paradigms based on dynamic collaborations. For final users, services offer a simplified access to functionalities and data. For organizations, the delegation of some business processes and the integration of external processes into the business logic have represented an opportunity to generate competitive advantages by saving costs, increasing the visibility in the market and exploiting the expertise of their partners by offering added-value product and services to their clients.

Despite the attractive advantages of the service-based technologies, the inherent loss of control on the exchanged resources is a well reported drawback which generates reluctance and decelerate their wide adoption. Basically, within organizations several business rules are associated to their resources in order to keep some properties over them and ensure that they are correctly used. Such a rules are associated not only to access control but to any condition aiming to prevent possible organizational damages, for instance, conditions ensuring the client satisfaction, preventing the loss of reputation or guaranteeing compliance with some standard or legal normative. However, from the moment the resource moves out beyond the walls of the organization there is no guarantee about whether the resource is used by respecting those established rules. The consequences of such loss of control on the usage are not trivial since the way in which the shared resources are used by the external partner may intentionally or unintentionally affects the organizational causing monetary fines, loss of customers or lawsuits. The impacts of such damages justify the need to having methods aiming to control the use on the shared resources during an external service provision. In this scenario, the challenge is how to guarantee that the external partner behaves as expected when the resource is in the domain of the external partner and when the business dependence of each organization need to be preserved.

This thesis proposes that the service provision, including the interaction between clients and providers, be governed by a service contract. This contract differs from traditional SLAs in several ways:

- It extends the expressiveness of the SLA service guarantees, traditionally based on security and performance, with contractual terms representing business requirements about the expected use of resources
- It is based on a formal semantics which avoids misinterpretations of the contractual terms thanks to a common understanding of their meaning.
- The compliance with the business requirements is inferred from the available knowledge collected during the contract execution.

Our contribution is framed in a governance approach which aims not only the creation of policies but also the implementation of some processes which evaluate and give feedback to those policies. Consequently, our controllability method is supported by two building blocks: a modeling component aiming the creation of policies and a process component. Regarding the modeling component, two complementary models are proposed. The first one is a generic semantic formalization of a service contract, which includes the definition of a controllability vocabulary. The second one is a specific model for the definition of controllability policies, which formalizes the expected behavior to the contractual parties and use the semantic model to give a clear meaning to the definition of each rule in the policy. In the process component, the available knowledge about the behavior of the contractual parties is used to verify the compliance with the policy. Similarly, such a knowledge, which has been recorded in a log, is further exploited to assess the quality of the provided service and select the partner based on his demonstrated behavior.

Our proposed method is validated through the creation of machine-readable contracts in OWL which contain controllability policies written as XML rules. Similarly, a log is implemented acting as a knowledge base where some reasoning aiming the auditing of the contractual parties is proposed.

Our proposed method, and more concretely the knowledge-based reasoning, opens new perspectives about the implementation of more sophisticated techniques of artificial intelligence applied to web services, improving existing research domains such as the semantic web services and intelligent web services. On the other hand, this thesis leaves some aspects untreated, notably, the negotiation of the contractual policy.

Keywords: contract, model, semantic, controllability policy, business rules, log, behavior, organizational assets, service.