Abstract

The work presented in this thesis is positioned in the context of Dynamic Service Composition (DSC) in SOA Architectures, in which Web and Agent Services are involved. The DSC must occur when a client request cannot be satisfied by any single available service, but by a combination. The thesis is focused on the synthesis phase or plan generation, according to the functional properties of the service, while the orchestration and monitoring of service execution are out of its scope. In this thesis a model of service discovery and the mechanisms for its dynamic composition are developed.

The main contributions of this doctoral work are the following. Firstly, a formal model for discovery and dynamic composition of services is developed. This model consists of the following phases: searching, ranking, selection and composition of services, if the latter is necessary. In respect of searching, this model allows to discover similar services, by means of three types of matching (exact, leftover and missing information). The two novel types of service matching (leftover and missing information) on the one hand, allow detecting the necessity for the DSC, and on the other hand, allow finding more alternatives of services, when ambiguity exists in the required service description, or when the exact matching between services is not possible. Also, the model allows calculating the similarity of the found services, by means of membership functions, for the purpose of ranking and further selection of services (together with customer’s conditions). The service composition takes place when the customer’s conditions are no fulfilled by found services or these services need information according to the required service, because of missing information matching. That is why, three forms to compose services appear in the model, according to the missing information (inputs and/or outputs).

Secondly, a semantic markup for Agent Service, OWL-AS, is developed as an extension of OWL-S language. OWL-AS allows to get the advantages of Semantic Web and to expand them to service description proposals developed by the Foundation for Intelligent Physical Agents (FIPA). As a consequence, agents can consider using different types of services indifferently and agent service descriptions can be understood by humans.

Finally, a service description expansion mechanism, inspired in query expansion for Web browsers, is developed, which allows to expand a required service description based on the different kinds of service matching.

These contributions are applied to agent technology, in order to help agents autonomously discover, find and run (atomic or composed) services.

In this thesis, the functionality of all contributions is exemplified in each section and reinforced in the case of study, in which the approach advantages for the integration of software applications for the petroleum industry are shown.