ODACE SLA: Ontology Driven Approach for Automatic Establishment of Service Level Agreements

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ABSTRACT

The establishment of Service Level Agreements between service providers and clients remains a complex task regarding the uninterrupted growth of the IT market. In fact, it is important to ensure a clear and fair establishment of these SLAs especially when providers and clients do not share the same technical knowledge. To address this problem, the authors started modeling client intentions and provider offers using ontologies. These models helped them in establishing and implementing a complete semantic matching approach containing four main steps. The first step consists of generating correspondences between the client and the provider terms by assigning certainties for their equivalence. The second step corrects and refines these certainties. In the third step, the authors evaluate the matching results using inference rules, and in the fourth step, a draft version of a Service Level Agreement is automatically generated in case of compatibility.

Keywords: Electronic Contract, Intention, Ontology, Quality of Service, Semantic Matching, Service Level Agreements

INTRODUCTION

According to the OASIS' definition “the Service Oriented Architecture (SOA) is a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains”. Thus, the ownership holds a key-role in realizing a SOA: for instance, who builds and makes a service available might be different from who consumes the service. As a consequence, service providers try to identify what are the potential requirements of their clients and develop the service accordingly. In the service oriented computing paradigm, an SLA is a collection of service level requirements that have been negotiated and mutually agreed upon by the provider and the consumer. The TeleManagement Forum worked out (in its SLA Management Handbook (TeleManagement Fo-
a split-up SLA lifecycle, consisting of six distinct phases: Development, Negotiation, Implementation, Execution, Assessment, and Decommission (Peer et al., 2006). Whilst the major part of SLA research concentrated on the development and the implementation issues of Service Level Agreements, the negotiation between customer and provider and therefore the creation of an agreement itself was insufficiently considered. Negotiation is one of the most important phases of an e-Business based collaboration, since it will define the conditions and terms that the service provider (and potentially customer) has to maintain during the lifetime of the collaboration. Obviously, one critical issue in the SLA lifecycle is to determine the Quality of Service (QoS) constraints in order to fulfill the client request. In fact, this request could be expressed using different words than the provider’s technical language. For example, in the scope of the ITEA2’s UseNet project², the public transportation network is equipped with high end communication facilities. A user of this network may want to download recent films on his netbook while waiting for the bus. Knowing that the waiting is about ten minutes, the download time of the film should not exceed this time slot. He also wants to pay less than 3 euros per film. On the other side, a provider has offers that can meet the client requirements but they are expressed in a different technical language. For example, the offers of the provider are based on the bandwidth that will be given for each user. The latter can be a non expert in the IT field and he may not understand the technical aspects of the bandwidth term and how it is computed. In this kind of situations, a fair and “intelligent” negotiation process is needed to match the client needs with the provider offers. The usual negotiation process consists in selecting a subset of clauses and values among predefined choices by the provider. However, the client may not understand these offers and, thus, has not the opportunity to express his needs with his own knowledge and language.

The challenge of our work is to propose an approach that helps the provider in analyzing a considerable number of client requirements (expressed in different words) and in identifying the suitable services or products that effectively meet their needs. In case of compatibility, we also aim to automatically generate an SLA between them. Consequently, our first objective in this work is to establish the necessary semantic enabled models that facilitate capturing the client’s requirements and the provider’s offers expressed by their own knowledge and their own languages. Our second objective is to analyze the correspondence between these models by defining an automatic semantic enabled matching process between them. In case of compatibility, our third objective consists in automatically generating a complete draft of an SLA between the client and the provider.

This paper reports innovative research on SLA with a focus on autonomous matching and establishment of QoS constraints. Our novel approach is composed of four steps. The first step consists in generating the correspondences between the client and the provider terms by assigning certainties to their similarity. The second step consists in refining and stabilizing these certainties in order to reduce the similarity measurement errors. The third step is a matching evaluation step in which we proceed to check the global similarity of the created correspondences. In this same step, we also use these correspondences to verify if the client constraints are satisfied according to the provider offers. Finally, in case of compatibility, our approach uses semantic inference techniques to automatically generate a draft version of an SLA in order to send it to the client after its validation by the commercial expert of the provider.

In Section “Modeling client intentions and provider offers” of this paper, we present the semantic enabled models that we have defined to capture the client’s intentions and the provider’s offers. In Section “A semantic matching approach between client intentions and provider offers”, we detail our automatic matching approach between these intentions and offers: Ontology Driven Approach for automatic Establishment of Service Level Agreements (ODACE SLA). In the next Section, we present the implementation and the testing results.
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