Verifying mediated service interactions considering expected behaviours

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ABSTRACT
Given the inherent autonomy, heterogeneity, and continuous evolution of Web services, mismatches usually exist between service protocols, and service interactions are typically conducted by means of adapters. A set of service protocols often can conduct multiple interactions, but a few, whose results fulfill the requestor’s requirements, are expected. In this paper, we propose a technique to verify whether a certain expected interaction is adaptable. Then, a requestor can choose a suitable provide service from a set of functionally equivalent candidates according to her requirements. This technique complements the effort of adapter synthesization for achieving an expected service interaction.

1. Introduction

Discovering and selecting a suitable provider service, which can interact with a requester service to achieve a certain goal, is a fundamental promise of service-oriented computing paradigm. Given the inherent autonomy, heterogeneity, and continuous evolution of Web services, mismatches usually exist between service protocols, and interactions are typically conducted by means of adapters (Tan et al., 2009). We call this kind of interaction a mediated service interaction, which is a common style of Web service interactions.

Existing techniques study service interactions from a global behaviour perspective without considering the requestor’s expectations. Indeed, two service protocols often can conduct multiple interactions, but, according to the requestor’s requirements, a few (in percentage) are interested whereas the others are not relevant. For instance in the motivating example (see Section 3), assuming the interaction leading Toy Items to be delivered is expected. Therefore, the criterion to select a suitable provider service is the support of these expected interactions, whereas the others are complementary but not mandatory. To achieve this selection criterion, we propose a formal technique which verifies whether an expected interaction can be mediated (Dumas et al., 2008).

1.1. Context

There are two types of method studying service interactions: (i) proposing user-defined techniques like Yellin and Strom (1997) or (ii) using techniques like model checking to verify certain properties of an interaction. We call the latter strategy a formal approach, where service interactions are formally modeled, and properties to be verified are usually specified in linear temporal logic (LTL) formulae. The verification can be achieved automatically. Since model checking methods trace through all relevant states with respect to a property which refer to all possible execution paths, the verification is more thorough and efficient. We follow a formal approach in this paper.

Verifying service interactions formally is an active research area and several methods (Fu, 2004; Kazhamiakin et al., 2006; Martens, 2005; Tarek et al., 2006) have been proposed where Fu (2004) proposes an inspiring method to study interacting Business Process Execution Language (BPEL) processes, which identifies sufficient conditions that determine when the conversations for bottom-up service compositions remains the same for synchronous and asynchronous communication semantics. We use this technique to perform our verification, due to our observation that a mediated service interaction is synchronizable.

We perform the verification in accordance to our Space-based Process Mediator (SPM) (Zhou et al., 2008). Note that our technique is general and can be applied to other adapters as well.

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