Chapter 1
An Integrated Framework for Semantic Service Composition Using Answer Set Programming (SSC-ASP)

Yilong Yang
University of Macau, Macau

ABSTRACT

Notwithstanding the advancement of service computing in recent years, service composition is still a main issue in this field. In this chapter, the authors present an integrated framework for semantic service composition using answer set programming. Unlike the AI planning approaches of top-down workflow with nested composition and combining composition procedure into service discovery, the proposed framework integrates a designed service workflow with automatic nested composition. In addition, the planning is based on service signature while validating through service contract. Moreover, a unified implementation of service discovery, selection, composition, and validation is achieved by answer set programming. Finally, the performance of proposed framework is demonstrated by a travel booking example on QWSDataset.

INTRODUCTION

Describe the general perspective of the chapter. End by specifically stating the objectives of the chapter.

Service computing has been extensively studied in recent years, and it mainly touches issues including formalizing the specification of service, service discovery, selection, and composition (Rao & Su, 2005; Dustdar & Schreiner, 2005). There are two primary paradigms for service composition: top-down and bottom-up paradigms (Bartalos & Bielikova, 2011). For top-down paradigm, we can specify the complex service workflow manually. Nevertheless, the bottom-up paradigm can composite services automatically by AI planing. Furthermore, a mixture paradigm is proposed in the paper (Paik, Chen, & Huhns, 2014). In this mixture paradigm, HTN is utilized to plan service workflow instead of manually designing. Like top-down paradigm to discover services, if matching more than one service, the best service can be selected. Same as a bottom-up paradigm to automatically composite service, if no existed service is matched, the procedure of the nested composition will be triggered to assemble the target service. However, automatic approaches usually are not the best solution for world-wild problems. Especially for workflow planning, AI planning approach is not correct all the time. Even though nested composition compensates this deficiency when planning service is coarse-grained, it would be a failure when dependent services are decomposed incorrectly. Therefore, new mixture approach for service composition is required. Regularly, service discovery and composition are regarded as two separate processes (Syu, Ma, Kuo, & FanJiang, 2012). In (Ku ̈ster, Ko ̈nig-Ries, Stern, & Klein, 2007), they proposed an approach to combining composition procedure into discovery process in compliance with multiple effects. However, the effects coverage must be computed foremost.

In order to address above issues, we propose an integrated framework for semantic service composition using answer set programming (SSC-ASP), which includes:

1. **A New Mixture Composition Paradigm:** Our approach combines top-down and bottom-up paradigms by designing a workflow for discovering and selecting service foremost, when no service is matched or discovered, a bottom-up nested composition procedure will be triggered.
2. **A Unified Procedure for Service Discovery and Composition (Using Simplified Service Description):** In order to boost planning and validation, we apply simplified service description to divide the target service (i.e., to discover and composite service) into the source and target services. Hence, service discovery and composition can be cooked in the identical procedure. The only difference is the length of composition chain. An outstanding advantage of this approach is not required to compute the multiple effects.

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