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A Comprehensive Multi-objective Approach of Service Selection for Service Processes with Twofold Restrictions

Helan Liang¹, Yanhua Du^{2,*}, Ting Jiang¹, Fanzhang Li¹

¹School of Computer Science & Technology, Soochow University, Suzhou, China

²School of Mechanical Engineering, University of Science and Technology Beijing, Beijing, China

e-mail: hlliang@suda.edu.cn; duyanhua@ustb.edu.cn; tjiang228@stu.suda.edu.cn; lfzh@suda.edu.cn

Abstract.

To build complex business processes with QoS constraints by services with inter-service correlations is a challenge. Meeting this challenge involves the QoS-aware service selection problem for service processes with twofold restrictions (QoS constraints and inter-service correlations). Recently, QoS-aware service selection has been addressed from a multi-objective perspective. However, existing research fails to comprehensively consider both QoS constraints and inter-service correlations that widely exist in a real business world. Besides, none of them comprehensively considers both service selection at build time and run time, which may lead to high economic compensation caused by breach penalties at run time. In this paper, we present a comprehensive multi-objective optimization model for service selection with twofold restrictions. Furthermore, an improved multi-objective evolutionary algorithm framework for this model (MOEAQI) is proposed, which can provide a systematic solution for service selection at build time and run time respectively. In this framework, a constrained-domination principle is designed for the specific objectives and constraints in different phases, and several improved strategies are proposed to increase the searching effectiveness and efficiency. Finally, three sets of experiments with different problem sizes are constructed, and our approach is tested in comparison to the state-of-the-art algorithms for service selection problems including GDE3, E³MOGA and NSGA-III. The performance of each algorithm is evaluated in the aspects of set coverage, spacing and computational time. Experimental results demonstrate that our approach is more effective than existing methods for service selection with twofold restrictions.

Keywords. Service selection; Service process; QoS constraint; Inter-service correlation; Multi-objective evolutionary algorithm

1 Introduction

With the diversity and complexity of business requirements, it is increasingly difficult for a single service to fulfill users' requirements [1-2]. Building complex business processes by integrating a set of services, which is known as service processes, has attracted increasing attention in recent years [3-4].

In a real business environment, to ensure the successful execution of service processes, QoS (Quality of Service) constraints are usually set explicitly by users, such as temporal and cost constraints to the whole or a part of the service processes [5-6]. Besides, QoS correlations are often set by service providers, since service providers usually make some discounts to promote more services to be selected [7-9], and compulsory dependency and conflict correlations occur due to business preferences and incompatibility of techniques [10-11]. Thus, to build service processes with QoS constraints by services

* **Corresponding author**

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