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A Diffraction Service Composition Approach Based on S-ABCPC:
An Improved ABC Algorithm

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ABSTRACT

In recent years, research on the QoS-aware service composition problem often assumes that each component service in the process to be solved is equally essential. They do not consider the impact of core component services and other component services on problem-solving, or even though their impact is considered, they are not fully considered. So this paper first proposes a diffractive method based on them. Considering the advantages of artificial bee colony (ABC) such as simplicity, this paper chooses it as the basic algorithm. In addition, with the continuous development of service ecosystem, it gradually formed a variety of domain features. They have an important influence on problem-solving, but the existing research has not explored this influence in-depth. Therefore, this paper digs deep into this influence. Given the characteristics of the problem to be solved in this paper, the S-ABCPC algorithm is designed. At last, experiments have proved the effectiveness of the method proposed in this paper. The impact factors of this method have been studied.

KEYWORDS

Artificial Bee Colony (ABC), Core Component Services, Diffractive Method, Domain Features, Quality of Service (QoS), S-ABCPC Algorithm, Service Composition, Service Ecosystem

1. INTRODUCTION

With the development of service-oriented computing, the real needs put forward by users are no longer simple. So basic services with a single function can hardly meet this demand. Service composition technology emerged under this background. A typical problem in service composition is the binding of each abstract component service in a process to a concrete Web service in the set of candidate services so that the binding result can satisfy a series of local qos constraints and global qos constraints, and the optimal solution is obtained. This typical problem is qos-aware service composition(Zeng

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et al., 2004). Many achievements have been made in the research on this problem, however, these studies identify that all component services in a service composition process are equally important. However, there are usually some component services that are core component services, that is to say, the quality of their binding results has a decisive and more significant impact on the quality of the overall combination result. The set formed by these core component services is called the core component service set. This is simply called the core service set. In addition, we note that due to the particularity of core component services in the service composition process, there will be some component services that can assist core component services and are closely related to them. This paper refers to these component services closely related to core component services as diffraction associated component services. The set formed by the corresponding diffraction associated component services is called the diffraction associated set. The core service set and the diffraction associated set have an essential influence on the solving of the service composition problem. For example, the core service set plays a leading role in the process of service composition, the performance of the core component services determine the performance of the entire composite service, the core service set and the diffraction associated set have an effect on improving the qos of the final solution result. In the previous related researches, when proposing methods to solve the service composition problem, the influence of core service set and diffraction associated set on problem-solving is often not considered, or even though their impact is considered, they are not considered in-depth and then used in a deeper level. To solve the above problem, this paper proposes a diffractive service composition method. This method adopts the processing method of distinguishing the primary and secondary and splitting the process to solve the problem. Specifically, this method first combines core component services, their corresponding diffraction associated component services and other corresponding component services using the corresponding algorithm for the first stage of combination. Secondly, uses the combined result of the first stage as the reference point, and uses the corresponding algorithm to combine it with the corresponding diffraction associated component services and other corresponding component services for the second stage of combination. After that, and so on until the combined result of the entire process is obtained.

The above answers the question "which solution method and strategy should be adopted in order to solve the composition problem" in this paper. Then based on the guidance of the method and strategy, use some suitable targeted algorithm to solve. So another question needs to be considered, that is, "now that the diffractive service composition method is adopted, what algorithm should we choose for solving the problem?" Considering the advantages of the ABC, and after our previous research, we found there is a strong correspondence and mapping between the mechanism of the optimization process of ABC and the solution process of service composition. For example, the behavior of honeybee colonies searching for the optimal food source corresponds to the process of finding the optimal solution to the composition problem, food sources correspond to feasible solutions in composition problems, the calculation of the fitness function corresponds to the calculation of the objective function of the composition problem, the end condition of the ABC corresponds to the end condition of the composition problem. Therefore, this paper chooses the ABC as the solution algorithm to solve the service composition problem. At present, some scholars have used ABC to solve the service composition problem(He et al., 2013) (Wang et al., 2013) (Chifu et al., 2010). However, these ABC-based solutions have some shortcomings, they often fail to consider the influence of domain features on the problem-solving process, or the effect of multiple domain features on the solution of the problem is not considered simultaneously, so the solution to the problem is out of touch with the actual situation in the service application, making the efficiency and effect of solving the problem not ideal. In fact, with the continuous development and evolution of service applications and service ecosystems involved in various service industries, gradually show the unique domain features in the service industry(such as priori feature, correlation feature, similarity feature and so on), they have an important influence on problem-solving. So this paper conducts an in-depth analysis of the optimization and running mechanism of ABC, mining the influence of multiple service domain