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Dynamic Service Selection with QoS Constraints and Inter-service Correlations Using Cooperative Coevolution

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Abstract.

Building business processes by Web services in cloud computing has become the hotspot of service applications. Due to the complexity and uncertainty of business environment, QoS violations of service processes often take place at run-time. To rapidly recover from failures and minimize their impacts on the original execution plan of service processes, dynamic service selection is urgently needed once potential QoS violations are detected. However, existing research works do not fully investigate QoS constraints and inter-service correlations, as well as the breach penalty caused by service adjustment. In this paper, we present a new cooperative coevolutionary approach for dynamic service selection with QoS constraints and inter-service correlations. First, a novel formal model for the dynamic service selection problem with QoS constraints and inter-service correlations is presented. Second, a Double Information based Cooperative Coevolutionary Algorithm (DICC) is proposed which uses Potter's cooperative coevolutionary framework and provides both local and global knowledge for the dynamic service selection optimization. Finally, we develop a prototype system to apply our approach and adopt different test cases to show that our DICC approach performs more effectively and efficiently than existing algorithms.

Keywords. Service process; Service selection; QoS constraint; Inter-service correlation; Cooperative coevolution

1 Introduction

Nowadays, more and more business components are encapsulated into Web services [1, 2]. Building business processes by composing a set of Web services (abbreviated to services in the rest of this paper) in cloud computing, which is known as service processes, has become the hotspot of service applications [3, 4].

Usually, a large number of services can provide similar functions with different Quality-of-Service (QoS), thus it leads to challenges to QoS-aware service selection which is to select a service for each activity in the service processes so as to optimize the overall QoS [5 - 7].

To ensure the successful execution of service processes, service selection is first executed at build time with satisfactory QoS. As a result, an execution plan about allocating suitable services and making reservations is made before the running of service processes [8 - 13]. However, QoS violations of service processes often take place at run-time due to the complexity and uncertainty of business environment [14, 15]. Keeping the original execution plan may affect the execution and even lead to

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