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Toward Service Selection for Workflow Reconfiguration: An Interface-Based Computing Solution

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Abstract—Due to the open and diverse features of the Internet, applications need an effective method of performing a workflow reconfiguration to achieve both the functional behaviors and non-functional requirements of workflow changes when a service failure occurs. This paper proposes a service selection method for workflow reconfiguration based on interface operation matching. First, formal models of service workflow and interface operations of Web services are defined, and functional behavior comparisons of service selections are performed to determine the operation coverage set that will fulfil all activities that predefine the form of an abstract process. Second, reconfiguration patterns are introduced to describe different solution types for service patterns, including one-to-one, one-to-many, many-to-many, and many-to-one modes. Third, to consider the quality of service (QoS), the quality of service workflow (QoW) is proposed according to control structures and service interface computing, and the unified QoW formula is then provided to effectively rank each reconfiguration plan to provide a top-k solution recommendation. Fourth, related algorithms and a case study are discussed to show the service selection process during the workflow reconfiguration. To support the engineering implementation, a novel service workflow reconfiguration architecture is designed to provide guidance, which ranges from monitoring to recommendations for project implementation. Finally, experiments are conducted to demonstrate the effectiveness and efficiency of the proposed method.

***Index Terms*—Service Workflow, Reconfiguration Patterns, Interface Operations, Quality Computing, Architecture Design**

1 INTRODUCTION

Modern enterprises must quickly respond to market changes under fierce business competition, and such responses involve business requirement analyses and dynamic process adjustments [1,2]. In practice, the traditional software engineering method should regenerate new modules by performing specific processes ranging from requirement analyses to system coding; however, the implementation of such processes for the development of new business software is time consuming and increases budget costs. To address these problems, workflow technologies have been widely used by the business and scientific communities to improve business process management (BPM) [3,4]. With the advantages of flexibility and customizability, BPM promotes business effectiveness and efficiency by striving for innovation, flexibility, and integration [5,6]. However, workflow is an abstract description of business process modeling. Methods of implementing business logic to perform predefined tasks should consider the particular problem of the workflow activity, especially in terms of supporting process execution in an e-commercial environment. As one of most important technologies available for BPM, service workflow adopts a service as a business function to achieve complex requirements requested by potential e-commerce systems and third-party applications. Thus, service workflow-based applications present low coupling characteristics and can operate in an agile mode, which can separate implementation from design when building target software. Workflow reconfiguration has the ability to provide new functions using mapping and integrating services as a new strategy, and then the reconfigured business logic can remain running without halting the process during system upgrading and exception handling.

As a cross-platform solution, a Web service is a software application designed to support interoperable machine-to-machine interactions over heterogeneous environments via a set of standard communication protocols [7,8]. An increasing number of companies have encapsulated their applications into services. The workflow composition of on-demand services represents a dynamic method of providing a value-added application via function aggregation, which enables the user to focus on business logic design without implementing code. Therefore, each activity of an abstract workflow can be dynamically realized by mapping a new service. However, with the exponential growth of Web services deployed on a network, many similar services are available with the same functionality [9], and they will display differ-

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