FAULT-TOLERANT EXECUTION PLANNING FOR COLLABORATIVE BUSINESS PROCESSES BASED ON GENETIC ALGORITHMS

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Received March 2011; revised July 2011

Abstract. In the present study, we developed a method that provides, while minimizing costs, guaranteed-reliable execution plans for collaborative business processes conducted via web services. To that end, physical- and time-redundancy techniques are utilized and dynamic modifications of execution plan are provided. In order to address the dynamic execution planning problem, known to be NP-hard, we also developed a Genetic Algorithm (GA), the effectiveness of which was demonstrated through a set of experiments. Specifically, the GA was shown to be capable of providing near-optimal solutions in polynomial time. The main contribution of this paper is the more general execution planning method developed in the present study. While previous research assumed that the execution cost, time, and reliability of web services are the same, we relaxed that assumption. We expect that this will facilitate the application of our method in practice.

Keywords: Collaborative business process, Quality of service, Web service, Fault-tolerance, Genetic algorithm

1. Introduction. A collaborative business process often is executed not only by internal processes but also via external web services [8,11-13]. Collaborating with a number of outside partners through web services requires sophisticated management of QoS (Quality of Service) aspects such as execution time, cost, reliability, availability, and others. Among the QoS aspects of a collaborative business process, reliable process execution has become more important [11]. For example, for a healthcare service process in which a number of partners collaborate through web services, reliable execution must be guaranteed. Although web service selection methods can be applied to web service QoS management, they do not guarantee reliable execution.

For the purposes of composite web service dependability [6], this paper presents a methodology that provides for dynamic execution plans at run-time. Previous studies