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Adaptive Composition in Dynamic Service Environments

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Abstract

Due to distribution, participant autonomy and lack of local control, service-based systems operate in highly dynamic and uncertain environments. In the face of such dynamism and volatility, the ability to manage service changes and exceptions during composite service execution is a vital requirement. Most current adaptive composition approaches, however, fail to address service changes without causing undesirable disruptions in execution or considerably degrading the quality of the composite application. In response, this paper presents a novel adaptive execution approach, which efficiently handles service changes occurring at execution time, for both repair and optimisation purposes. The adaptation is performed as soon as possible and in parallel with the execution process, thus reducing interruption time, increasing the chance of a successful recovery, and producing the most optimal solution according to the current environment state. The effectiveness of the proposed approach is demonstrated both analytically and empirically through a case study evaluation applied in the framework of learning object composition. In particular, the results show that, even with frequent changes (e.g. 20 changes per service execution), or in the cases where interference with execution is non-preventable (e.g., when an executed service delivers unanticipated quality values), our approach manages to recover from the situation with minimal interruption.

Keywords: service composition, adaptive service execution, quality of service, request-based dominance

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