A Novel Statistical Cost Model and an Algorithm for Efficient Application Offloading to Clouds

This work presents a novel statistical cost model for applications that can be offloaded to cloud computing environments. The model constructs a tree structure, referred to as the execution dependency tree (EDT), to accurately represent various execution relations, or dependencies (e.g., sequential, parallel and conditional branching) among the application modules, along its different execution paths. Contrary to existing models that assume fixed average offloading costs, each module’s cost is modelled as a random variable described by its Cumulative Distribution Function (CDF) that is statistically estimated through application profiling. Using this model, we generalize the offloading cost optimization functions to those that use more user tailored statistical measures such as cost percentiles. We employ these functions to propose an efficient offloading algorithm based on a dynamic programming formulation. We also show that the proposed model can be used as an efficient tool for application analysis by developers to gain insights on the applications’ statistical performance under varying network conditions and users behaviours. Performance evaluation results show that the achieved mean absolute percentage error between the model-based estimated cost and the measured one for the application execution time can be as small as 5% for applications with sequential and branching module dependencies.