TOWARDS REALISTIC SCHEDULING FOR HETEROGENEOUS SYSTEMS

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Abstract

With the increase in demand for computing power, large scale distributed systems, comprising a wide variety of heterogeneous resources, become a cost-effective way of running large, complex applications. However, the complexity of these applications (in the most common case represented by a Directed Acyclic Graph - DAG) as well as the heterogeneity and the dynamic nature of the underlying, distributed, execution environment create a number of challenges in terms of mapping applications onto the resources. This thesis abstracts away some of the scheduling problems related to these challenges and advances the state-of-the-art by proposing algorithms to solve such problems.

First, two algorithms are developed to minimise the overall application execution time when scheduling single applications in static environments. The first algorithm is designed for independent task scheduling; the second algorithm deals with DAG scheduling. An empirical investigation of the latter algorithm's performance is carried out in terms of both makespan and the impact of different weighting methods.

Using the proposed algorithms as a basis, the second part of the thesis develops a rescheduling policy that extends the applicability of existing static algorithms to a dynamic environment. This policy offers a low-cost, efficient solution to generate good schedules with inaccurate resource predictions.

After examining single-DAG scheduling problems, the problem of multiple DAGs, competing for the same resources, is considered. The issue of fairness is examined, and two algorithms are developed to produce fair schedules.

Finally, solutions are given for the problem of advance reservation for both single and multiple DAGs. Experimental results show that the proposed techniques can provide solutions that achieve good performance.