PREFACE

In distributed computing, a big computational application is solved by dividing it into many tasks and executing them onto different processing units. The distributed computing environment may be homogeneous in which all processors have same processing capabilities, or it may be heterogeneous in which all processors are comprised of different processing capabilities. It involves potentially a great deal of communication overhead which restricts the performance of applications if tasks are not scheduled efficiently. The scheduling of tasks, with precedence constraints, on different processors is one of the core concerns for distributed computing in multiprocessor environments and significantly relies on the techniques employed to schedule the tasks with the aim of optimizing makespan and energy consumption. The task scheduling problem is known to be NP-complete. Therefore, many task scheduling algorithms are proposed in literature to solve this problem and new methods keep coming in. It is always useful to look for a fresh approach, towards understanding and interpretation of the existing algorithms and such an effort may lead to some possible newer ways of solving the problem.

The thesis benchmarks some well-known task scheduling algorithms for distributed computing on multiprocessors and proposes a possible framework for this purpose. The proposed approach provides for generation of graphs through a Directed Acyclic Graph generator, then produces schedules through a scheduler which makes use of scheduling algorithms and finally analyses the results obtained by using various performance metrics. The proposed framework is general in nature.

The work also attempts to propose some new algorithms for working out possible scheduling, of tasks that optimize makespan. We propose two clustering-based algorithms for scheduling of precedence constrained tasks in multiprocessor environments. The first algorithm proposes and uses the idea of edge prioritization to obtain

meaningful clustering of the tasks. The second algorithm makes use of edge zeroing concept on the critical path to reduce the communication cost among the tasks of an application. We have performed an average analysis of the results obtained for various real-world application graphs and random graphs. Along with average analysis, we also performed a statistical analysis of the results using confidence intervals.

Further, we propose an energy-aware scheduling algorithm for multiprocessor environments which aims to reduce power consumption by exploiting dynamic voltage and frequency scaling technique. This algorithm is an energy aware version of our first proposed algorithm and uses the idea edge prioritization to save energy consumption. It also studies the slack time for non-critical tasks, extends their execution time and reduces the energy consumption without increasing the makespan of the application. The simulation experiments conducted with four well-known energy aware scheduling algorithms for some selected benchmark random graphs demonstrate that the proposed energy-aware scheduling algorithm achieves more energy saving than compared algorithms.

DEDICATED

To
My Beloved Parents, Wife and Son