Abstract of Thesis presented to UFF as a partial fulfillment of the requirements for the degree of Master of Science in Computer Science(M.Sc.)

A Two Stages Cluster-based Strategy for Scheduling Tasks on Heterogeneous Processors

José Viterbo Filho

October, 2004

Advisor: Prof. Maria Cristina Silva Boeres, Ph.D
Department: Computer Science Engineering

This work focuses on the problem of scheduling tasks of a parallel application onto a heterogeneos set of processors in a distributed system. Due to its importance, the task scheduling problem has been the subject of a large amount of studies and several techniques have already been proposed for solving this problem, which is known to be NP-complete in its general form. At first, list scheduling algorithms, which account for the heterogeneity of the target systems, may seem more appropriate for scheduling tasks onto a heterogeneous environment such as computational grids. However, its known that clustering heuristics produce efficient schedulings for homogeneous environments, particularly when the communication costs are higher

than the mean computation costs. The purpose of this work is to study the applicability of formerly proposed cluster-based algorithms with replication for scheduling tasks onto computational grids. This work presents a two stage strategy for scheduling applications in a bounded set of heterogeneous processors called Clustering for Heterogeneous Processors (CHP). In the first stage, clusters of tasks are created to minimise the communications costs. The second stage, called Cluster Mapping Algorith (CMA), which is proposed in this work, implements policies for mapping clusters on heterogeneous processors so that the makespan of the application is minimised. The proposed algorithm has a list scheduling framework and exploits the features of both the clusters and the target system. To validate the applicability of the algorithm, the results produced by CHP were compared to those produced by two other well known algorithms from the literature, which are specific for a bounded number of heterogeneous processors. The analysis of the results shows the advantage of applying the proposed approach, particularly when the communication costs are high.