THE COMPARISON OF TARDINESS IN SCHEDULING TECHNIQUES FOR TASK DISTRIBUTION USING GRID SIMULATION TOOL

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ABSTRACT

Grid computing is a form of distributed computing that involves coordinating and sharing computing, application, data storage or network resources across dynamic and geographically dispersed organizations. Today scheduling in Grid computing involves much static and fix algorithm. Research on Grid scheduling focuses in solving three problems: finding a good algorithm, automating the process, and building a flexible, scalable, and efficient scheduling mechanism. The complexity of scheduling problem increases with the size of the Grid. The goal of this project is to test on tardiness parameter in local search based algorithms. A good scheduling algorithm normally shows lower value of total tardiness and schedule time. In this project, the comparisons of scheduling techniques were done in simulation Grid. The implementation was tested and evaluated on universal datasets using GridSim 4.1. Tabu Search has been selected for its efficiency in distributing jobs. The result shows that the performance of tardiness is directly related to the number of machines up to certain number of resources. Small and medium company can use grid in operation process because it saves cost and time.

ABSTRAK

Pengkomputeran Grid merupakan satu bentuk pengagihan yang melibatkan koordinasi dan perkongsian komputer, aplikasi, data storan atau sumber rangkaian yang dinamik dan tersebar secara geografi. Pada masa kini penjadualan dalam satu Grid pengkomputeran melibatkan algoritma statik dan tetap. Penyelidikan penjadualan Grid menumpukan kepada penyelesaian tiga masalah: mencari satu penjadualan yang terbaik, pemprosesan automatik, dan pembangunan mekanisme yang fleksibel dan dapat dijadikan ukuran kecekapan. Kerumitan masalah penjadualan bertambah dengan saiz Grid. Matlamat utama projek adalah untuk menguji parameter kelewatan dalam algoritma berasaskan gelintaran setempat. Teknik penjadualan yang terbaik biasanya menunjukkan nilai kelewatan paling minimum dan masa penjadualan yang terendah. Bagi projek ini, perbandingan teknik penjadualan dilakukan untuk agihan tugas dalam Grid simulasi. Pentaksiran telah diuji dan dinilai menggunakan GridSim 4.1. Gelintaran Tabu Search dipilih kerana kecekapannya dalam agihan tugas. Keputusan ujian menunjukkan prestasi kelewatan berkadar kepada bilangan mesin sehingga satu peringkat sumber. Syarikat kecil dan sederhana dapat memanfaatkan Grid dalam proses operasi disebabkan ia menjimatkan kos dan masa.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1   Introduction

The scheduling problem, in general, has been studied broadly in many areas, such as transportation systems, industrial operations, system control, and medical operations. Today the scheduling in a Grid computing involves much manual administrative work. Research on Grid scheduling focuses on solving three problems: finding a good schedule, automating the scheduling process, and building a flexible, scalable, and efficient scheduling mechanism.

For this project, the focus was on tardiness parameter versus time and tested on local search based algorithms (Tabu search) for scheduling techniques using multiple jobs on limited resource. Only one scheduling technique has been selected because this example shows how tardiness working on scheduling techniques.

GridSim is the simulation tool environment that can simulate scheduling and execution of different types of non preemptive jobs in both static and dynamic fashion on

resources composed of parallel and heterogeneous machines. System administrator demands on resource utilization can be satisfied by schedule time minimization and user requirements can be handled through optimization of the total tardiness of all jobs. The simulation environment allows an easy testing for the scheduling algorithms.

1.2   Scheduling

Scheduling has two important meanings. Firstly, scheduling is a decision-making function: to determine a schedule. Secondly, scheduling is a body of a theory; it is a collection of principles, models, techniques and logical conclusion. Scheduling function is the allocation of resources over time to perform a collection of task raised in a variety of situations. Scheduling is a decision as a system approach. There are four primary stages of the system approach [1]:

1.   Formulation stage is where the problem is identified and the criteria to guide decision making are determined.

2.   Analysis stage is the detailed process of examining the elements of a problem and their inter-relationships: It is also aimed at identifying the decision variables and relationships among them and the constraint they must obey.

3.   Synthesis is the process of building alternative solution to the problem.

4.   Evaluation is the process of comparing these feasible alternatives and selecting a desirable course of action.

The three goals of decision making are in common with the goal of scheduling:

1.   Efficient utilization of resources.

2.   Rapid response to demands.

3.   Close conformance to set deadlines.

1.3   Problem Background

Grid scheduling is a very complex problem where application of advanced scheduling techniques is often not easy. The Grid scheduling problem is generally defined by a set of resources (typically machines, storage, memory, network, etc.), a set of tasks, an optimality criterion, an environmental specification and by other constraints.

The number of submitted jobs in grid environment is large, these jobs are normally put in a queue, although scheduling techniques used in the grid schedules the jobs, but there is extra delay in the process of scheduling these jobs and sending them to their assigned resources. Total tardiness and schedule time has play important role on this queue numbers of job. The proper scheduling when the schedule can pass the job to the machines at lower schedule time and lower tardiness. The goal of the scheduling is to satisfy users and system demands, e.g. to minimize the total tardiness of the jobs or to minimize the schedule time.

There are a few reasons why scheduling is such a difficult problem. One is the size and complexity of the search space. The second reason is scheduling inherently dynamic process. Schedules only remain valid for a limited amount of time. The third factor that makes scheduling difficult is different domains and applications required solutions of different variations of the scheduling problem. These variations arise from a number of different sources [2].

The performance is usually measured in terms of the quality of the schedule (the total schedule time) and the running time of the algorithm. Sometimes, the number of target machines allocated is also taken as a performance parameter. Furthermore, using more machines can possibly result in a better solution.

Various algorithms are used to minimize the schedule time, the total tardiness or the number of delayed jobs. This project concentrates on some of the interesting results with the total tardiness minimization and demonstrates on GridSim simulator.

1.4 Problem Statement

Previous techniques of Grid scheduling have been implementation in many environments but still need to be improved. This project examines the question:

How to compare scheduling technique from the aspect jobs distribution on Grid?

     i.   *How to identify the scheduling parameters?*

     ii.   *How to minimize the total tardiness of the jobs in scheduling?*

     iii.   *Have the numbers of machine will affect of total tardiness?*

1.5 Project Objectives

The objectives of the project are:

i. To study and compare the existing scheduling system and the utilizations in applications.

ii. To setup the scheduling technique in the Grid simulation environment.

iii. To test and evaluate the performance of tardiness and schedule time in the Grid simulations.

1.6 Project Scopes

The scopes of the project are:

i. The comparative study of previous Grid scheduling techniques.

ii. Focus on tardiness and schedule time for scheduling techniques in jobs distribution.

iii. Test and evaluate in the grid simulation using GridSim platform.

1.7   Project Contributions

This project gives better insights and idea or solution for scheduling technique through tardiness versus time for multiple jobs on limited resource.

1.8   Outline of Thesis

The outline for this thesis is as follows:

• Chapter 2 covers the literature review of this project, which introduces scheduling, Grid and the processes of scheduling. This is followed by brief explanation on scheduling techniques.

• Chapter 3 discuses the methodology used in this project. It covers experimental design as well as performance evaluation.

• Chapter 4 highlights the results of the experiments conducted. There is also a discussion, which includes analysis and result comparison of the performance evaluation done.

• Chapter 5 is the conclusion and the description of future research for this report.

1.9   Summary

Nowadays, the Grid scheduling becomes larger compared than recent years, where only small programs and execution sequentially are necessary. This project describes the comparison of tardiness in scheduling technique for task distribution in Grid simulation tool. Scheduling technique used for this project is Tabu Search.

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