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Scheduling Jobs on Cloud Computing Using Glowworm Swarm Optimization Algorithm

by

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Abstract

Cloud computing is a technique which provides computing resources as services, and allows users to access them via the Internet without the need to own knowledge and experience, or even control of infrastructure that support these services. Job scheduling is considered one of the main issues in cloud computing. The main task of job scheduling is how to find an optimal mapping of set of jobs to the set of available resources. Unsuitable mapping of jobs to resources usually leads to inefficient cloud performance. The available mechanism for cloud job scheduling process produce acceptable solution but not optimal solution.

This research proposes a new job scheduling mechanism using Glowworm Swarm Optimization (GSO). The proposed mechanism aims to find the best mapping in order to minimize the execution time of jobs. The proposed mechanism based on information of jobs (cloudlets) and resources (virtual machines) such as length of job, speed of resource and identifier for both. The scheduling function in the proposed job scheduling mechanism firstly creates a set of jobs and resources to generate the population by assigning the jobs to resources randomly and evaluates the population by using the fitness value which represent the execution time of jobs. Secondly the function used iterations to regenerate populations based on glowworms behavior to produce the best job schedule that gives the minimum execution time of jobs.

The methodology of this research started with initial work using Java language to develop programs that simulate the proposed GSO mechanism. This phase is followed simulation of the proposed mechanism using the CloudSim simulator. The evaluation process of the proposed mechanism started with a set of different experiments. These experiments revealed that, the proposed mechanism minimized the execution time of jobs. The proposed mechanism is compared with the First Come First Servers (FCFS) algorithm and experimental results revealed that the proposed mechanism has a better performance than FCFS for minimizing the execution time of jobs.

المستخلص

الحوسبة السحابية هي التقنية التي توفر الموارد الحاسوبية كخدمات، والسماح للمستخدمين الوصول إليها عبر شبكة الإنترنت دون الحاجة إلى إمتلاك المعرفة والخبرة، أو حتى السيطرة على البنية التحتية التي تدعم هذه الخدمات. جدولة الوظائف تعتبر واحدة من القضايا الرئيسية في الحوسبة السحابية. المهمة الرئيسية لجدولة الوظائف كيفية العثور على التعيين الأمثل من مجموعة الوظائف لمجموعة من الموارد المتاحة. التعيين غير المناسب من الوظائف للموارد عادة ما يؤدي إلى التأثير في أداء السحابية. الآلية المتاحة لعملية جدولة وظائف السحابة تنتج حل مقبول ولكن ليس الحل الأمثل

. إقترح هذا البحث طريقة جدولة جديد بإستخدام خوارزمية Glowworm Swarm Optimization (GSO) بهدف إيجاد أفضل تعيين من أجل تقليل وقت تنفيذ الوظائف. الآلية المقترحة تعتمد على معلومات من الوظائف (cloudlets) والموارد (الأجهزة الظاهرية) مثل طول الوظيفه، وسرعة المورد ومعرف لكلاهما. دالة الجدولة في آلية جدولة الوظائف المقترحة يخلق أولاً مجموعة من الوظائف والموارد لتوليد السكان عن طريق تعيين الوظائف إلى الموارد بشكل عشوائي وتقييم السكان بإستخدام قيمة اللياقة البدنية التي تمثل وقت تنفيذ الوظائف. ثانياً تكرار إعادة توليد السكان على أساس سلوك glowworms لإنتاج أفضل جدول الوظيفة الذي يعطي وقت تنفيذ أقل للوظائف.

منهجية منهجية هذا البحث بدأت مع العمل الأولي بإستخدام لغة جافا لتطوير البرامج التي تحاكي آلية GSO المقترحة. ويتبع هذه المرحلة محاكاة الآلية المقترحة بإستخدام محاكاة CloudSim. بدأت عملية تقييم الآلية المقترحة مع مجموعة من التجارب المختلفة. وكشفت هذه التجارب أن الآلية المقترحة قلل من وقت تنفيذ الوظائف. تتم مقارنة الآلية المقترحة مع خوارزمية First Come First Servers (FCFS) وكشفت النتائج التجريبية أن الآلية المقترحة لديها أداء أفضل من FCFS للتقليل من وقت تنفيذ الوظائف.

1.1 Overview

This chapter introduces the research work, state the problem, defines research objectives, significant and describe the thesis structure.

1.2 Problem Background

As the IT technologies are growing day by day, the need of computing and storage are rapidly increasing. Cloud Computing has become a widely accepted paradigm for high performance computing, because in Cloud Computing all type of IT facilities are provided to the users as a service. The services of the cloud are provided through the Internet. In Cloud Computing the term Cloud is used for the service provider, which holds all types of resources for storage, computing etc. Mainly three types of services are provided by the cloud. First is Infrastructure as a Service (IaaS), which provides cloud users the infrastructure for various purposes like the storage system and computation resources. Second is Platform as a Service (PaaS), which provides the platform to the clients so that they can make their applications on this platform. Third is Software as a Service (SaaS), which provides the software to the users and hence the user don't need to install the software on their own machines and they can use the software directly from the cloud. Cloud Computing provides many benefits: it results in cost savings because there is no need of initial installation of much resource; it provides scalability and flexibility, the users can increase or decrease the number of services as per requirement; maintenance cost is very less because all the resources are managed by the Cloud providers[1].

Job scheduling is one of the major activities performed in all the computing environments. Cloud computing is one the upcoming latest technology which is developing drastically. To efficiently increase the working of cloud computing environments, job scheduling is one the tasks performed in order to gain maximum profit.

The goal of scheduling algorithms in distributed systems is spreading the load on processors and maximizing their utilization while minimizing the total task execution time Job scheduling, one of the most famous optimization problems [2].

Job scheduling has been considered as one of crucial problems in cloud computing. An optimized scheduler would improve many factors in scheduling of tasks in a cloud system such as throughput and performance. Different Approaches have tried to solve this problem like Genetic algorithm, Ant colony optimization, Particle swarm optimization and etc.

1.3 Problem Statement

Suppose that R= $\{r_1, r_2, r_3 \ldots r_s\}$ are s cloud resources and J= $\{j_1, j_2, j_3 \ldots j_m\}$ are m independent jobs. The speed of each resource is expressed in form of MIPS (Million Instructions Per Second), and the length of each job is expressed in the form of number of instructions. The problem is how to allocate the submitted jobs to the available resource in order to complete the jobs efficiently and to minimize the execution time, such that an optimum execution time is achieved.

1.4 Research Objectives

The objective of this research is to propose a new job scheduling mechanism with modified distance to minimize the execution time based on Glowworm Swarm Optimization algorithm and to evaluate the proposed mechanism using CloudSim simulator.

1.5 Thesis Structure

This thesis contains six chapters, Chapter 2 Gives an overall idea of cloud computing, and scheduling algorithm on cloud computing. Chapter 3 Describes the Research Methodology. Chapter 4 Describes the Proposed Scheduling Mechanism. Chapter 5 Presents the Results and Discussion. Chapter 6 Provide the Conclusion and Recommendations.