Abstract

In order to optimize the task scheduling strategy in cloud environment, we propose a cloud computing task scheduling algorithm based on ant colony algorithm. The main goal of this algorithm is to minimize the makespan and the total cost of the tasks, while making the system load more balanced. In this paper, we establish the objective function of the makespan and costs of the tasks, define the load balance function. Meanwhile, we also improve the initialization of the pheromone, the heuristic function and the pheromone update method in the ant colony algorithm. Then, some experiments were carried out on the Cloudsim platform, and the results were compared with algorithms of ACO and Min-Min. The results shows that the algorithm is more efficient than the other two algorithms in makespan, costs and system load balancing.

Task Scheduling Based on Ant Colony Optimization in Cloud Environment

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1 Introduction

Cloud computing is the latest computing model for a variety of applications, data and IT services over the web [1]. At present, cloud computing is applied to all walks of life in society. In the specific implementation process of cloud computing, task scheduling or resource scheduling is an unavoidable link, which directly determines the efficiency of the whole system. The cloud computing system has a large scale of resources, heterogeneous resources, wide user base, different types of application tasks, QoS target constraints are different, cloud computing systems have to deal with a large number of user tasks and massive data [2]. Therefore the cloud computing task scheduling strategy has been the hot spot that is difficult to study, and we need an efficient algorithm for task scheduling in the cloud environment [3]. A good task scheduler should adapt its scheduling strategy to the changing environment and the types of tasks [4]. And task scheduling problems are a typical NP-hard problem. Therefore, a dynamic task scheduling algorithm, such as ant colony optimization (ACO), is appropriate for clouds. ACO can be used to solve many NP hard problems such as traveling salesman problem [5], graph coloring problem [6], vehicle Routing and scheduling problems [7].In this paper we proposed a Multi-objective Optimization Algorithm for Cloud Computing Task Scheduling Based on Improved Ant Colony Algorithm (MO-ACO) to find the optimal resource allocation for each task in the dynamic cloud System which minimizes the makespan and costs of tasks on the entire system, and balance the entire system load. Then, this scheduling strategy was simulated using the Cloudsim toolkit package. Experimental results compared to Ant Colony Optimization (ACO) and Min-Min showed the MO-ACO algorithm satisfies expectation. The organization of paper is as following. Section II introduces the related work. Section III introduces a cloud model and presents the problem statement of the multi-objective task scheduling. Section IV details the proposed MOACO algorithm. Section V presents the simulation results. Finally, Section VI concludes this paper.

2 RELATED WORK

At present, the cloud computing task scheduling mechanism has not yet formed a unified standard and norms. Many scholars have studied the task scheduling from the makespan, the optimal span, the cost, the reliability, the energy consumption and so on as the optimization goal according to the characteristics of cloud computing task scheduling.[8] focus on virtual machine load balancing, and propose a cloud computing task scheduling algorithm based on load balancing ant colony optimization algorithm. [9] proposed a task scheduling algorithm based on improved particle swarm, which takes into account the total task completion time and the total task completion cost, but does not consider the system load balancing. [10] focus on multi-dimensional QoS, and propose a multidimensional QoS cloud scheduling algorithm based on immune clone to meet the resource load and user's time requirement. [11] proposed based on ACO and CUCKOO hybrid algorithm to reduce the task execution time. A multiinput multi-output feedback control of dynamic resource scheduling algorithm was proposed [12] to guarantee optimal effectiveness under time constraints. This algorithm considers the task execution time, cost, and utilization of resources (CPU, Memory). The paper [13] proposes a multi-objective task scheduling method by minimizing makespan and costs in a heterogeneous multi-cloud environment.

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Figure 1: Caption