A Hybrid approach for task scheduing using the cuckoo and Harmony search in cloud computing

T. Prem jacob[1]

Abstract. Cloud Computing is a gathering of physical and virtualized assets gave to the clients according to request and pay per uses bases via internet. Basically, the task scheduling and resource allocation two features are considered such as cost and makespan. In order to achieve better performance in task scheduling, resource allocation and task scheduling must be precisely organized and optimized jointly. Several works have been published in the literature to do the scheduling in cloud. In this paper, for enhancing the scheduling process cuckoo search (CS) and harmony search (HS) algorithm is hybrid as CHSA to improve the optimization problem. These two algorithms are effectively combined to do intelligent

process scheduling. According to this, a new multi-objective function is proposed by com- bining cost, energy consumption, memory usage, credit and penalty. Finally, the performance

of the CHSA algorithm is compared with different algorithms such as existing hybrid cuckoo gravitational search algorithm, individual CS and HS algorithm with various multi-objective parameters. By analyzing the result our proposed CHSA algorithm attain minimum cost, minimum memory usage, minimum energy consumption, minimum penalty and maximum credit compared to existing techniques.

Keywords: Multi-objective Cuckoo search Harmony search Task scheduling Cloud computing CHSA Cost Memory usage Energy consumption Credit Penalty.

1 Introduction

Distributed computing is a model empowering pervasive, advantageous, on-request organize access to a shared pool of configurable computing resources (e.g.,systems, ser- vers, storage, applications, and administrations) that can be quickly provisioned and dis- charged with negligible administration exertion or service provider interaction. In Cloud

Computing the term Cloud is utilized for the service provider, which holds all types of resources for storage, computing etc. [1]. Cloud computing can be defined as a type of distributed system comprising of an accumulation of interconnected and virtualized PCs that are powerfully provisioned. It gives at least one consolidated computing resources

based on service-level agreements (SLA) between the service providers and service con- sumers [2]. Distributed computing has a few difficulties (e.g., security, execution, resource

administration, reliability, and so forth.) [3]. One of the resource management issues is identified with task scheduling. Task scheduling on Cloud processing alludes to allocating the clients' task on the accessible assets to enhance execution of task, and increase resource utilization [4]. Distributed computing has a few difficulties (e.g., security, execution, resource administration, reliability, and so forth.) [3]. One of the resource management issues is identified with task scheduling. Task scheduling on Cloud processing alludes to allocating the clients' task on the accessible assets to enhance execution of task, and increase resource utilization [5]. For successfully tackling the capability of cloud computing efficient task scheduling is one of the major step. In cloud computing, a number of tasks may need to be scheduled on different virtual machines in order to minimize make span and increase system utilization [6]. Thus task scheduling plays a key role to improve flexibility and reliability of systems

in cloud [4]. But the task scheduling has an extensive optimization issue and NP Com- pleteness problem; it gives a major contribution to improve reliable and extensible

dynamic systems [7]. So most of the task scheduling algorithms used in cloud computing are rule based [8] because they are easy to implement. Rule based algorithms perform poorly when it comes to complex task scheduling problems [9].Also the resource scheduling and allocation are not only related to quality of service (QoS) [10], but also can affect the profits of the cloud service provider directly. At present, resource scheduling has become the hot issue in the field of cloud computing, and a series of resource scheduling algorithms have been presented by the scholars. From this the solution to the related problem is Traditional cloud computing algorithms The development of present day scheduling algorithms has been firmly identified with disclosures in the zone of artificial intelligence that are generally utilized these days to take care of this kind of issue [11]. As distributed computing conditions need to scale to a extensive number of customers and assignments, illustrating a scheduling algorithm that can proficiently spread the assets and errands transforms into a key point for investigate. Introduce day look into employments different probabilistic methods, for example, hereditary calculation, insatiable calculation, the Ant Colony (ACO) calculation and the Particle Swarm Optimization calculation (PSO) [12]. In this paper, we proposed multi-objective-based task scheduling using a combination of cuckoo search and harmony search algorithm. The multi-objective function used in this paper is to cost, energy consumption, memory usage, penalty and credit. Based on the multi-objective function we obtain the scheduled task. The major contribution are made in the research for task scheduling process as follow,

- An approach namely CHSA is done for task scheduling, which has the advantages of quickly converging and easily realizing. So that this scheduling method is able to get an optimal or suboptimal solution in a high profit than individual cuckoo search algorithm and harmony search algorithm.

- Multi objective based task scheduling problems in cloud computing are the focus by considering minimization of cost, energy consumption, memory usage, penalty and maximum credit in the heterogeneous multi-cloud environment.

The rest of the paper is organized as follows: a brief review of some of the literature works based on task scheduling in cloud computing is presented in Sect. 2. In Sect. 3 the background of the proposed method is explained in detail. Problem evaluation of our proposed method is given in Sect. 4. The proposed technique for hybrid multi-objective optimization algorithm for task allocation in virtual machines using proposed CHSA is given in Sect. 5. The experimental results and the performance evaluation discussion are provided in Sect. 6. Finally, the conclusions are summed up in Sect. 7.

2 Related Work

Literature presents several techniques for scheduling in cloud computing environment. Here, we review some of the works related to the job scheduling. Zhu et al. [13] have developed a scheduling in cloud computing. Here, they designed calculation rules of the bidding values in both forward and backward announcement-bidding phases. Moreover, they developed independent and periodic tasks in clouds using an agent-based dynamic

scheduling algorithm named ANGEL. This method was addressing the issues of schedu- lability, priority, scalability, realtime in virtualized cloud environment. Even though this

method was not consider the communication and dispatching times and it cannot improve the resource utilization rate. Moreover, One of the most challenging problems in Clouds is

workflow scheduling, i.e., the problem of satisfying the QoS of the user as well as mini- mizing the cost of workflow execution. To overcome the issues, Alkhanak et al. [14] have

explained a cost aware work flow scheduling in cloud computing. The cost-aware sig- nificant difficulties of workflow scheduling (WFS) in cloud computing are arranged in

view of Quality of Service (QoS) execution, framework functionality and framework design, which at last outcome in a taxonomy set.

Shi et al. [15] have presented an Energy-Efficient Scheduling Scheme for Time-con- strained Tasks in Local Mobile Clouds. Here, they first develop the mathematical models

of the mobile devices. Then, find out the problem and develop probabilistic scheduling algorithm for scheduling purposed. In mobile cloud computing, how to utilize MCC to enable mobile devices to run complex real-time applications while keeping high energy efficiency remains a challenging problem. To overcome the problem multi objective task scheduling is developed. Jiang et al. [16] have developed multi-objective algorithm for task scheduling and resource allocation in cloud-based disassembly. Here they developed two objectives such as makespan and minimizing the total cost. The multi objective problem solved using non-dominated sorting genetic algorithm II. This method was efficient but it takes maximum time to execution and system complexity. Morshedlou and Meybodi [17] have introduced a proactive resource allocation approach for cloud computing environments. The main aim of this method was decreasing impact of SLA violations. The scheduling is just based on SLA parameters. From the result, this method was high applicability in service oriented environments like as cloud, even though this method was cost effective. Due to increment in the utilization of distributed computing there is a requirement for a proficient and viable resource allocation algorithm which can be utilized for appropriate use of the resources and furthermore check that the asset isn't wastage. Therefore, Gouda et al. [18] have presented priority based resource allocation in cloud computing. This method mainly utilized the priority not consider the load. Therefore

sometimes the virtual machines are over loaded. In [19], Juarez et al. have limits a multi- target function which consolidates the vitality utilization and execution time as per the

energy execution significance figure given by the resource supplier or client, likewise considering succession subordinate setup times between assignments, setup times and down circumstances for virtual machines (VM) and vitality profiles for various designs. From the literature survey, we understand all the works are well organized for scheduling. But each work has some limitation such as maximum cost, time, less QoS parameters and complexity. Moreover, most work utilizes the single objective function for scheduling. The single objective functions are not effective for all the scheduling methods. To overcome the difficulties present in the above mentioned works, in this paper, we develop a multi objective based task scheduling using hybrid algorithms.

3 Background

In this section, we explain the background of the hybrid algorithm. Then, we explain the proposed multi objective task scheduling.

3.1 ***Cuckoo Search***

Cuckoo search algorithm is a swarm-intelligence-based algorithm. This algorithm was inspired by natural behaviour of cuckoos. In this algorithm, each egg in a nest indicates the candidate solution. In general, each cuckoo can lay just a single egg into a nest in unique shape albeit each nest can has different eggs representing a set of solution. The main objective of CS is to create new solutions that will replace the worst solutions in the current nest population. The step by step process is explained below;

Step 1: Initialization Phase In this section, a population of nest (solution) is created randomly ($S_i, where i = 1, 2, ...n$).

Step 4: Updation Phase After fitness calculation, the new solution is created using Eq. (2).//

$I_i^{New} = I_i^{(t+1)}) = I_i^t + \alpha + Levy(\lambda)$

3.2 ***Harmony Search Algorithm***

Harmony Search algorithm was inspired by the improvisation of Jazz musicians. In par- ticular, the procedure by which the musicians (who have never played together) quickly

refine their individual act of spontaneity through variety bringing about an aesthetic har- mony; this HS calculation method appeared in Fig. 1.//

Step 1: Intialization

Initialize the number of solution is the important process in optimization algorithms. In this, we initialize the parameter used in this harmony search algorithm also. Number of parameters is used in this method such as Harmony Memory Size (HMS), Harmony Memory considering Rate (HMCR), HMCR; 2 1⁄20; 1 and Pitch Adjusting Rate (PAR); 2 1⁄20; 1.

Step 2: Intialize the harmony memory(HM)

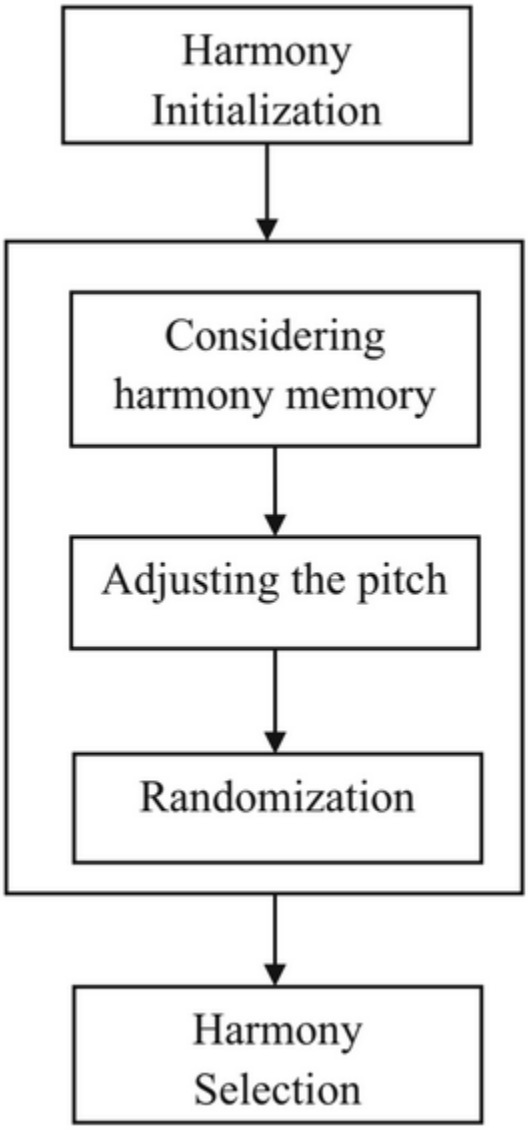

Fig 1 Harmony search process