Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 65 (2015) 682 – 690

Procedia Computer Science

International Conference on Communication, Management and Information Technology (ICCMIT 2015)

Hybrid Algorithm for Resource Provisioning of Multi-tier Cloud Computing

Marwah Hashim Eawna[a], Salma Hamdy Mohammed[b], El-Sayed M. El-Horbaty[a,b,*]

[a] *Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt*
[b] *Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt*
[ab*] *Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt*

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: marwa_safaar@yahoo.com, s.hamdy@cis.asu.edu.eg, shorbaty@cis.asu.edu.eg

Abstract

Cloud computing is a model for delivering information technology services in which resources are retrieved from the internet through web-based tools and applications. The most important challenges are influenced to adopt the cloud computing technology such as security, resources allocation and resources provisioning. The only existing resource provisioning mechanisms in cloud computing using meta-heuristic technique are based on single tier application. In this paper we propose dynamic resources provisioning in multi-tier application by using meta-heuristic technique such as Particle Swarm Optimization (PSO) algorithm, Simulated Annealing (SA) algorithm and hybrid algorithm that combine Particle Swarm Optimization (PSO) and Simulated Annealing (SA). The simulation results show that resource provisioning based on PSO-SA algorithm in multi-tier application is much faster than resource provisioning in multi-tier application based on PSO algorithm and SA algorithm, that is beneficial in the development of cloud computing.

Key Words: Cloud Computing, Resources Provisioning, PSO-Particle Swarm Optimization, SA-Simulated Annealing.

1. Introduction

Cloud computing is an evolving concept which makes better using of multiple distributed resources, cloud users use resource that is provide by the cloud service provider, the important aim in provisioning resource is maximum performance in minimum time, to minimize the total time taken, the scheduling principle should aim to reduce the amount of data transfer with minimum cost and ensure balanced distribution of tasks as per processing capability[1].There are entirely two generic architectures of resource provisioning, single tier and multi-tier, the single tier architecture has relatively simple structure and easy to setup and everything means database, application and presentation are at same place. Most modern Web sites use a multi-tier architecture, this architecture partitions the application process into multiple tiers, each tier provides a certain functionality. Most multi-tier Web applications use a 3-tier architecture: presentation tier, application tier and data tier. The basic feature of cloud computing is the ability to dynamically providing resources scaling, dynamic provisioning is a useful technique for handling the virtualized multi-tier applications in cloud environment[2]. A request in dynamic provisioning technique moves through the tiers, may visit a tier multiple times and get processed at the visited tier. Finally, the processing completes and returns to request senders from the front tier[3].

Some new search techniques involving nature-inspired meta-heuristics have become the new focus of resource provisioning and allocation research in single tier cloud computing such as Particle Swarm Optimization (PSO) which inspired by the social behavior of bird flocking and fish schooling, and Simulated Annealing (SA) that inspired by the way

Peer-review under responsibility of Universal Society for Applied Research
doi:10.1016/j.procs.2015.09.012

in which a metal cools into a minimum energy crystalline structure (the annealing process) and search for a minimum in a more general system. In this paper we propose dynamic resources provisioning in multi-tier cloud computing based on PSO algorithm and SA algorithm and hybrid algorithm that combine PSO-SA algorithms.

The rest of this paper is organized as follows: Section 2 an overview on the related work algorithm. In Section 3, we describe the proposed PSO, SA and PSO-SA algorithm to provide resources in multi-tier cloud computing. Experimental results are presented in Section 4. Section 5 contain conclusion and future work.

2. Related works

Resource provisioning problem has been an important topic in the cloud computing. To solve this problem we need to improve resource utilization and provisioning in minimum time and cost with effectiveness of system and meet Service Level Agreement (SLA). This problem has attracted a lot of attention from the research community in the last few years. In the following we provide a review of most relevant prior work.

Suraj Pandey et al.[4] presented a scheduling heuristic based on Particle Swarm Optimization (PSO). They used the heuristic to minimize the total cost of execution of scientific application workflows on Cloud computing environments.

1: Calculate average computation cost of all tasks in all compute resources
2: Calculate average cost of (communication/size of data) between resources
3: Set task node weight $w_{i,j}$ as average computation cost
4: Set edge weight $e_{k1,k2}$ as size of file transferred between tasks
5: Compute PSO($\{t_i\}$) /* a set of all tasks $i \in k$*/
6: **repeat**
7: **for** all "ready" tasks $\{t_i\} \subseteq T$ **do**
8: Assign tasks $\{t_i\}$ to resources $\{p_j\}$ according to the optimized particle position given by PSO
9: **end for**
10: Dispatch all the mapped tasks
11: Wait for *polling_time*
12: Update the ready task list
13: Update the average cost of communication between resources according to the current network load
14: Compute PSO($\{t_i\}$)
15: **until** there are unscheduled tasks

Fig. 1: The pseudo code of PSO algorithm in Single tier application

They calculate the average computation cost (assigned as node weight in Figure 1) of all tasks on all the compute resources. This cost can be calculated for any application by executing each task of an application on a series of known resources and scheduling the tasks depending on this cost. The experiment based on figure 1 show that when use PSO in task-resource mapping we can achieve at least three times cost savings as compared to Best Resource Selection.

Othman et al.[5] Proposed a novel Simulated Annealing (SA) algorithm for scheduling tasks in cloud environments. SA exploits an analogy between the way in which a metal cools and freezes into a minimum energy crystalline structure (the annealing process) and the search for a minimum in a more general system.