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A Review: Metaheuristic Technique in Cloud Computing

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Abstract - *In the space of a few years, Cloud computing has experienced remarkable growth. Indeed, its economic model based on demand of hardware and software according to technical criteria (CPU utilization, memory, bandwidth or package has strongly contributed to the liberalization of Computing resources in the world. In this paper we have survey various type of meta-heuristic based technique which treated with the task scheduling, load balancing, ACO, PSO, GSA in cloud computing.*

***Key Words*: Cloud computing, Meta-heuristic technique, ACO, GA, PSO, GSA, Load balancing, Cloud Scheduling**

1. INTRODUCTION

1.1 What is a cloud computing?

Cloud computing can be defined as "a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service providers and consumers". Cloud computing is a model that enables on demand access to a shared pool of configurable computing resources. Cloud computing is an evolving technology. Cloud computing delivers infrastructure, platform, and software that are made available as subscription-based services in a pay-as-you-go model to consumers. These services are referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) in industries. Cloud computing is Internet- based computing. Although many formal definitions have been proposed, NIST provides a somewhat more objective and specific definition here "Cloud computing is a model for enabling convenient, on- demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that scan be rapidly provisioned and released with minimal management effort or service provider interaction."Cloud computing is a new kind of model, is coming. The use of Internet and new technologies nowadays, for business and for the current users, is already part of everyday life. Any information is available anywhere in the world at any time and every day its being used more this services that are called cloud computer services.

1.2 Scheduling in cloud computing-

The Scheduler is responsible for organizing the execution of work units composing the applications, dispatching them to different nodes, getting back the results, and providing them to the end user. The Executor is responsible for actually executing one or more work units, while the Manager is the client component which interacts with the Aneka system to start an application and collect the results. The assumptions made for algorithm has to be designed are as follows.

1.There is a master node which is the only node responsible for users to submit jobs into the cloud service.
2. The master node-approved jobs are the only ones running on any node in cloud infrastructure. Master node evaluates the best node which can execute the application on the basis of the CPU availability of slave machines.

1.3 Type of clouds

Private cloud: A cloud that is used exclusively by one organization. The cloud may be operated by the organization itself or a third party. The St Andrews Cloud Computing Co-laboratory8 and Concur Technologies [13] are example organizations that have private clouds.

Public cloud: A cloud that can be used (for a fee) by the general public. Public clouds require significant investment and are usually owned by large corporations such as Microsoft, Google or Amazon.

Community cloud: A cloud that is shared by several organizations and is usually setup for their specific requirements. The Open Cirrus cloud test bed could be regarded as a community cloud that aims to support research in cloud computing.

Hybrid cloud: A cloud that is setup using a mixture of the above three deployment models but applications and data would be allowed to move across the hybrid cloud.. Each cloud in a hybrid cloud could be independently managed. Hybrid clouds allow cloud bursting to take place, which is where a private cloud can burst-out to a public cloud when it requires more resources.

1.4 Meta-Heuristic Techniques

These techniques also make use of random solution space for scheduling the tasks but the main difference between

heuristic and meta-heuristic is that heuristic methods are problem specific while meta-heuristic methods are problem independent. They generally use population based concepts inspired by social behavior of insects such as Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Tabu Search algorithm and Honey bee foraging algorithm etc.

Load Balancer: This mechanism contains algorithms for mapping virtual machines onto physical machines in a cloud computing environment, for identifying the idle virtual machines and for migrating virtual machines to other physical nodes. Whenever a user submits an application workload into cloud system, one can create a new virtual machine. Now the mapping algorithm of Load balancer will generate a virtual machine placement scheme, assign necessary resources to it and deploy the virtual machine on to the identified physical resource. Load Balancer will have the following three sub modules.

Manager: It triggers live migration of VMs on to physical servers depending on information provided by the VM Mapper. It turns a server 'on' or 'off'.

Monitoring Service: This module collects parameters like status of application, workload, utilization of resources, power consumption etc. This service works like global information provider that provides monitoring data to support intelligent actions taken by VM mapper. The status information is utilized to arrest the sprawl of unmanaged and forgotten virtual machines.

VM Mapper: This algorithm optimally maps the incoming workloads (VMs) on to the available physical machines. It collects the information from monitoring Service time to time and makes decision on the placement of virtual machines. The VM mapper searches the optimal placement by a genetic algorithm.

2. LITERATURE SURVEY

A. Jain et al. [1] have discussed the evolution of computing from mainframe to cloud computing. Authors have discussed the basic characteristics, type and architecture of cloud computing. Moreover, authors have also discussed the different research issues and applications of cloud computing.

Zhang Huan-Qing et al.[2] proposed a task scheduling algorithm based on Load Balancing Ant Colony Optimization in Cloud Computing. This algorithm keeps load balance by adjusting pheromone factors and improving updating rules for pheromone factors. Others aim at obtaining load equality to the highest level while taking into account the built-in attribute and load of each resource joint.

T. Liao et al [3] proposed a new approach for Ant colony optimization. ACO is a probabilistic technique for solving computational problems. They used ACO in cloud and grid computing task scheduling, etc, but it doesn't get a good performance since there are still some problems in pheromone update and the parameters selection. However, PACO also has some problems, such as the selection of the parameters and the way getting pheromone. In order to let Ant colony optimization get a better performance, a self adaptive ant colony optimization has be proposed in this paper which improves PACO.

C. Y Liu [4] represented a task scheduling based strategy on genetic ant colony algorithm in cloud computing was proposed, which used the global searchability of GA to find the optimal solution, and converted to the initial pheromone of ACO. Task scheduling problem in cloud computing environment is NP-hard problem, which is difficult to obtain exact optimal solution and is suitable for using intelligent optimization algorithms to approximate the optimal solution. Meanwhile, quality of service (QoS) is an important indicator to measure the performance of task scheduling.

X. F. Liu et al [5] proposed that Cloud computing resources scheduling is essential for executing workflows in the cloud platform because it relates to both the execution time and execution costs. For scheduling T tasks on R resources, an ant in ACS represents a solution with T dimensions, in solving the problem of optimizing the execution costs while meeting deadline constraints, they developed an efficient approach based on ant colony system (ACS). Compare the results with those of particle swarm optimization (PSO) and dynamic objective genetic algorithm (DOGA) approaches.

Jinhua Hu et al [6] gave explanation about the current virtual machine(VM) resources scheduling in cloud computing environment mainly considers the current state of the system but seldom considers system variation and historical data, which always leads to load imbalance of the system. In view of the load balancing problem in VM resources scheduling, this paper presents a scheduling strategy on load balancing of VM resources based on genetic algorithm.

Bhathiya Wickrema Singhe et al [7] presented advances in Cloud computing opens up many new possibilities for Internet applications developers. However, there is a lack of tools that enable developers to evaluate requirements of large-scale Cloud applications in terms of geographic distribution of both computing servers and user workloads.

Kun Li et al [8] clarified about cloud computing is experiencing a rapid development both in academia and industry; it is promoted by the business rather than

academic which determines its focus on user applications. This technology aims to offer distributed, virtualized, and elastic resources as utilities to end users. It has the potential to support full realization of 'computing as a utility' in the near future.

A. Jain et al [9] have proposed a new load balancing approach for cloud computing. Proposed approach has used the concept of biased random walk. Biasing has been achieved through task size, and available capacity of virtual machine. Proposed approach has not only improved the load balancing but also improved the reliability of the system.

B. Shaw et al [10] an efficient approach has been proposed in this paper, they explained GSA (intelligence based heuristic optimization method) is implemented for economic operation of a two area power system. The advantage of the method is that it is applicable to both linear, nonlinear as in the case of PSO. The results obtained by GSA are compared with the conventional method and PSO.

U. K. Rout et al [11] A novel Economic Operation of Two Area Power System through Gravitational Search Algorithm has been proposed, which is based on the AGC. This method is explained with an example and the result obtained by the proposed method is compared with by particle swarm optimization as reported in literature. It has been shown that this method is more efficient and takes less computation time than PSO. The economic operation of two area (Grid) power system by GSA is presented.

P. K. Roy [12] represented a Meta heuristic method for optimization known as GSA In this paper GSA is implemented to economic operation of a two area power system and computes how much power has to be generated internally in an area and how much power has to be borrowed from other area through tie-line for a specified load in most economical sense.

G -B. Wang et al [13] proposed there are many researches on VM scheduling strategy. One well-known strategy is centralized VM live migration scheduling scheme. The scheduler mainly consists of two components: central controller and local migration controller. The central controller obtains all the physical resources utilization on the whole, and then initializes the VM migration based on pre-specified policies so as to achieve load balancing and high resource utilization.

R. N. Calheiros et al [14] In this approach, authors proposed a novel distributed VM migration strategy to solve the above problems. In our strategy, distributed local migration agents autonomously monitor there source utilization of each PM. If the agents finds that the PM is in high load condition. The proposed ACO-Based VM Migration Strategy (ACO-VMM) uses artificial ants to find an ear-optimal mapping of PMs and VMs.

A. Jain et al [15] presented a hybrid load balancing approach for cloud environment by combining the best feature of join idle queue, join shortest queue and minimum completion time approach. Moreover, authors have added the prior overloading checking mechanism. Authors have tested the proposed approach on cloud analyst simulator and it has been found that proposed hybrid approach JIMC has outperformed all the basic approach on all the relevant parameter.

A. Beloglazov et al [16] reviewed the performance metrics that evaluate the simulation result, such as energy consumption, number of SLA violations. The utilization of RAM is set as 50%.The proposed technique is very effective not only for accumulate pheromone in the iteration times but also prevent the quick convergence resulted from the over-accumulated pheromone. Beloglazov and Buyya proposed a useful metric called SLAV (SLA Violations) to evaluate the SLA delivered by a VM in an IaaS cloud.

M. A. Tawfeek et al [17] proposed a cloud task scheduling policy based on ant colony optimization algorithm, of which the main goal was minimizing the make span of a given tasks set. A task scheduling based on genetic ant colony algorithm in cloud computing was proposed, which used the global search ability of GA to find the optimal solution, and converted to the initial pheromone of ACO. They proposed a task scheduling strategy with QoS constraints based on GA and ACO.

S. C. Wang et al [18] in this paper, the authors stressed, the importance 01' choosing the appropriate node in the Cloud for the execution of a task. The authors have also introduced the use 01' agents in collecting available information such CPU capacity and remaining memory. Finally, they proposed a scheduling algorithm gathering the qualities of two algorithms the opportunistic load balancing (OLB) and the load balance Min-Min.

Wen et al [19] proposed that Ant Colony algorithm can also be combined with other algorithms such as particle Swarm Optimization to improve its performance. It not only enhances the convergence speed and improves resource utilization ratio, but also stays away from falling into local optimum solution.

ZHUO Tao et al [20] proposed an improved Ant Colony Optimization (IACO) to improve the cloud computing utilization. The proposed IACO algorithm improves pheromone factors and inspired factors innovatively based on the existent algorithms. Emulation tests are conducted in the CloudSim and the results indicate that IACO is superior to the conventional ACO and the latest IABC in task executing efficiency.

Y. Gao et al [21] the authors of the research study introduced a multi objective ant colony system algorithm in order to ensure an efficient placement of virtual machine (VM). Through this paper, the authors aim to implement solutions which reduce both the total resource wastage and power consumption. Proposed algorithm to the existing multi-objective genetic algorithm and two single-objective algorithms, highlight the fact that the proposed algorithm is more efficient than the previous algorithms.

N. M. Saberi et al [22] A GSA algorithm has been proposed to find the solution more efficient than PSO. As the computation time is low in GSA, it can be implemented on-line. It has been pointed out that the convergence of GSA is quite slow towards end (near the optimum value).In this paper, the GSA (intelligence based heuristic optimization method) is implemented for economic operation of a two area power system.

Shahdan Sudin et al [23] A new velocity update strategy is proposed in this paper , in which new velocity depends on the previous velocity and the acceleration, based on the fitness of the solutions. The proposed strategy is named as fitness based gravitational search algorithm (FBGSA). In FBGSA, the high fit solutions are motivated to exploit the promising search regions, while the low fit solutions have to explore the search space.

Pacini et al [24] addressed the problem of balancing throughput and response time when multiple users are running their scientific experiments on online private cloud. The solution aims to effectively schedule virtual machines on hosts. Cloud computing has become a buzzword in the area of high performance distributed computing as it provides on demand access to shared resources over the Internet in a self service, dynamically scalable and metered manner

M. Berwal et al [25] proposed load balancing algorithms in Cloud can be classified as immediate mode scheduling and batch mode scheduling. The immediate mode scheduling organizes tasks based on its arrival by applying a minimum execution time and minimum completion time algorithms. One major aspect for dealing with performance issues in Cloud computing is the load balancing.

3. CONCLUSIONS

The paper reviewed the importance of cloud computing in almost every field. It makes provisioning, scaling, maintenance of your apps and serves a breeze. In the studied literature, most of the authors have focused on task scheduling, ant colony optimization, genetic algorithm, PSO and GSA. Task scheduling in cloud computing means based on the current information of task and resource and in accordance with a certain strategy to build a good mapping relationship between tasks and resources. Comparisons show the Ant colony optimization is better than other technique.

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