VIRTUAL MACHINE PLACEMENT BY USING HONEY BEE FORAGER ALGORITHM IN CLOUD COMPUTING

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Abstract

Cloud computing is growing rapidly in the distributed systems for utilizing and sharing large-scale resources on demand. It becomes the primary source of computing for both enterprise and personal computing applications. User is able to connect the Virtual Machine which is in data centre by online with an internet connection and browser enabled device. Virtual machine placement is a process of placing the virtual machine in right physical machine. The goal of perfect algorithm is to minimize total resource and power consumption. The algorithm should be multi objective, many parameter has to be considers. The paper proposes the use of honeybee forager in VM placement problem, and is experimented with various overload detection and VM selection policy.

Keywords : *Honey bee foraging, Cloud Computing, energy, virtual machine, resource, scheduling, load balancing.*

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I. Introduction

Cloud computing in data centre reduced the cost to the cloud provider and flexible computing capabilities with limitless computing power to the user. Easy to create, destroy and move of virtual machine in the internet by using cloud computing change the way how the computing use to know[4]. Data is everywhere no need of backup or pen drive, easy to access just need is an internet connection in any device which supports an internet browser. Computing power is so high and is available on pay as use means you pay only time and energy it process. Cloud Computing is consists of clusters of distributed computers (Clouds) providing on-demand resources or services over a network with the scaling properties and reliability of a data centre. In the dark side data centre consume lots of power for computing the resource and for cooling proposes. Scheduling of this big resource is mandatory to reduce the power consumption which can be achieved by proper load balancing of the data centre[3]. Virtual machine placement is to search the right host for every virtual machine. Minimum no's of the host can definitely reduce the power and migration policy of virtual machine can shut down the idle host which will reduce the power. Migration of virtual machine in cloud computing is to balance the load by moving from overloaded host to lightly loaded host. Overall cloud system with power on and power off method is present in Figure1.

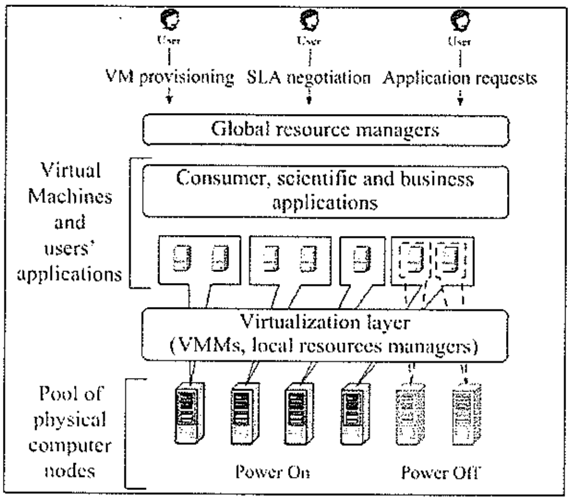

Figure 1 : Cloud System [13]

The remainder of this paper is organized as follows. Section 2 gives problem description, Section 3 shows the related work, section 4 proposed method with description of Honey Bee algorithm, section 5 workload descriptions. Finally, section 6 experimental results in table and chart with conclusion.

II. Problem Description

Virtual machine placement is an NP hard problem different methodology has been proposed many researchers. The problem of virtual machine placement in data centre is defined as : given a set of virtual machines $VM = \{vm_1, vm_2, ..., vm_n\}$ and a set of physical machines $PM = \{pm_1, pm_2, ...pm_m\}$, where each vmi is a triplet $vm_i = (cpu_i, ram_i, bw_i)$, $1 \leq i \leq n$ denoted cpu, memory and bandwidth requirements of virtual machine respectively. Each pmj is also a triplet $pm_j = (cpu_j, ram_j, bw_j)$, $1 \leq j \leq m$ denoted resource capacity of the physical machine. In addition, x_{ij}, $1 \leq i \leq m$, $1 \leq j \leq n$ and y_i, $1 \leq i \leq m$ are decision variables, $x_{ij} = 1$ if and only if vm_j is mapped onto pm_i, $y_i = 1$ if pm_i is used to host virtual machine. The objective is to minimize $\sum_{i=1}^{m} yi$ while finding all values of x_{ij}.

There are several implicit constraints in the above definition:

- Each virtual machine can be hosted on only one physical machine;
- For each type of resource, the amounts of resource requests of virtual machines sharing the same physical machine are smaller or equal to capacity of the physical machine hosting them;
- The number of physical machines that host virtual machines are not more than m, $\sum_{j=1}^{m} yi \leq m$.[11]

To give a solution for virtual machine placement this work focus on using Honeybee forager algorithm which is a nature inspired algorithm which tries to track the activities of the bee to get their food. First they select scout bee to go and search a wide domain of areas, if a scout bee finds a potential food resource it returns to its hive and does a waggle dance which tells other bees the direction and the distance of the potential food resource. A set of selected bees goes to the food resource and starts bringing in the honey while other scout bee's does the same work and sets of bees are sent to a different location to bring in the food. After every identification of food resource the scout bee informs others and sets its course for other new sites nearby the potential food resource. Using these activities we define terms as in no of scout bees (n), no of sites selected out of n visited sites (m), no of best sites out of the whole set (e), no of bees recruited for the best sites e (nep), no of bees recruited for other sites (m-e).

III. Related Work

Stage and Setzer [7] describe a network-aware migration scheduler which takes into consideration the workload type of each VM. The migration takes into explicit consideration the network topology and the bandwidth requirements to move VM images within a given deadline.

Wood et al. [8] describe Sandpiper, a system which automatically identifies performance bottlenecks, identifies a new VM allocation which removes them and finally initiate the required migrations to instantiate the new allocation. Sandpiper is OS and application independent, relying on monitoring disk and network usage inside the Xen VM monitor.

Das et al. [9] present a multi-agent system approach to the problem of green performance in data centre. As for aforementioned papers, the framework is based on a hierarchy, according to which a resource arbiter assigns resources to the application managers, which in turn become in charge of managing physical servers.

Srikantaiah et al. [10] study the impact of consolidation of multiple workloads with different resource usage on performance, energy usage, and resource utilization. This is not achieved by migrating applications, but rather by consolidating the workload so that each server receives a "balanced mix" of requests.

Finally, Barbagallo et al. [16] describe a bio-inspired algorithm based on the scout-worker migration method, in which some entities (the scouts) are allowed to move from one physical node to another in order to cooperatively identify a suitable destination for VMs (the workers) which are migrated.

IV. Proposed Method

Several researchers has proposed to solve Virtual Machine problem by using different methodology, this work focus on Virtual Machine placement in heterogeneous cloud data centre with various Virtual Machine configuration. Virtual Machine can be scientific application,

Nature-inspired algorithm have received a lot of research attention in seeking distributed method, to address the increasing scale and complexity in such systems [5] this nature based algorithm has its own feature which can be directly applied or modified to suit the goal of any research. Honey bees behaviour in search of honey is applied in many applications. It is one of a number of applications inspired by the believed behaviour of a colony of honey bees foraging and harvesting food. Forager bees are sent to search for suitable sources of food; when one is found, they return to the hive to advertise this using a display to the hive known as a "waggle dance". The suitability of the food source may be derived from the quantity or quality of nectar the bee harvested, or its distance from the hive. This is communicated through the waggle dance display. Honey bees then follow the forager back to the discovered food source and begin to harvest it. Upon the bees' return to the hive, the remaining quantity of food available is reflected in their waggle dances, allowing more bees to be sent to a plentiful source, or exploited sources to be abandoned. This biologically-inspired technique is now used as a search algorithm in a variety of computing applications; seeming particularly scalable on a fluctuating underlying system[1][2].

1. Initialize population (*N* bees) at random
2. Evaluate fitness of population (fittest bee is the queen, *D* fittest following bees are drones, *W* fittest remaining bees are workers)
3. *While* stopping criteria are not satisfied (Forming new population)
/* **reproduction behavior** */
4. Generate *N* broods by **crossover** and **mutation**
5. Evaluate fitness of broods
6. If the fittest brood is fitter than the queen then replace the queen for the next generation
7. Choose *D* best bees among *D* fittest following broods and drones of current population (Forming next generation drones)
8. Choose *W* best bees among *W* fittest remaining broods and workers of current population (to ensure food foraging)
/* **food foraging behavior** */
9. Search of food source in *W* regions by *W* workers
10. Recruit bees for each region for **neighborhood search** (more bees *(FBest)* for the best *B* regions and *(FOther)* for remaining regions)
11. Select the fittest bee from each region
12. Evaluate fitness of population (fittest bee is the queen, *D* fittest following bees are drones, *W* fittest remaining bees are workers)
13. *End while*

Figure 2: Bees Life Algorithm pseudo-code [15]

Considering the food source as Host (Physical Machine) and bees as a VM (Virtual Machine) and hive as a load balancing server. Cloud computing is a heterogeneous distributed system, host as well as VM is in heterogeneous and even the cloudlet (task) of the user. Request of processing a cloudlet is different from one another, based on the cloudlet properties cloudlet are assigned to different VM, and VMs are created on different hosts. Allocation of VM is done on host based on the VM constant (size, memory, mips, storage), and a proper load balancing method is required so that all VM are created successfully in the Host with minimum time and achieving the SLA of the user. Allocation of VM to host can be done by method call VmAllocationPolicy, these policy responsibility is proper allocation of VM to host and if needed to perform VM migration and reduce the energy consumption and fulfil the SLA[5][6]. Pseudo code of honey bee is mention on Figure2 [14][15].

V. Workload Data

For our experiments we have used data provided as a part of the CoMon project, a monitoring infrastructure for PlanetLab (http://comon.cs.princeton.edu). The workload data is available with CloudSim package[12][13].

VI. Experimental Result

From the experimental result it is found that Honey bee with Overload detection of MAD policy and VM selection of Maximum Correlation policy gives less energy consumption, VM migration and SLA. This algorithm will give better QoS. The proposed VM placement algorithm is experimented with various Overload detection and VM selection policy. Experimental result is shown in Table 1, and chart of various parameters comparing with different overload detection is shown in Figure 3, 4, 5, 6.

Table 1 : Honey bee VM placement with various overload and VM selection

Honey Bee VM Placement	DATASET : 20110303	HOST: 800	VM : 1052
VM Policy Name	*Energy, KWH*	*VM Migration*	*SLA, %*
DVFS	49.58	0	0
IQR_MC	23.39	1133	0.00104
LR_MC	22.68	1155	0.00115
LRR_MC	22.46	1133	0.00119
MAD_MC	22.10	1081	0.00103
THR_MC	22.31	1135	0.00118

DVFS-Dynamic Voltage Frequency Scaling, IQR-Interquartile Range, LR-Local Regression, LRR-Robust Local Regression, MAD-Median Absolute Deviation, THR- CPU utilization threshold, MC-Maximum Correlation

Below are the chart for the comparison with Honey Bee and various overload detection and VM selection

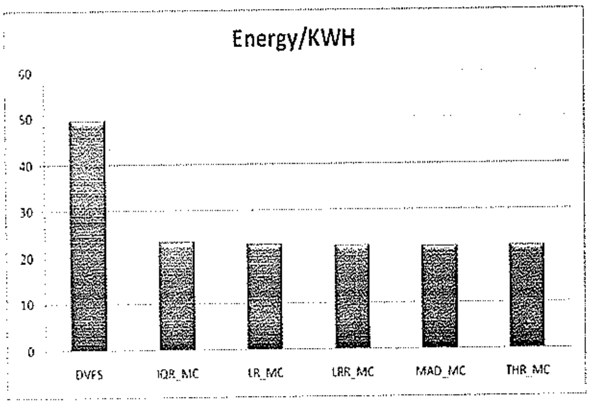

Figure 3 : Energy Graph

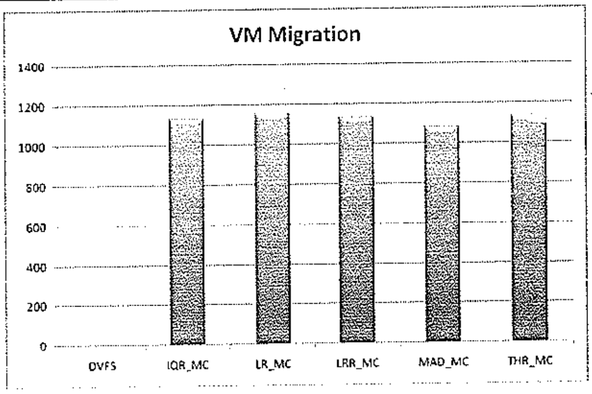

Figure 4 : Virtual Machine Migration Graph

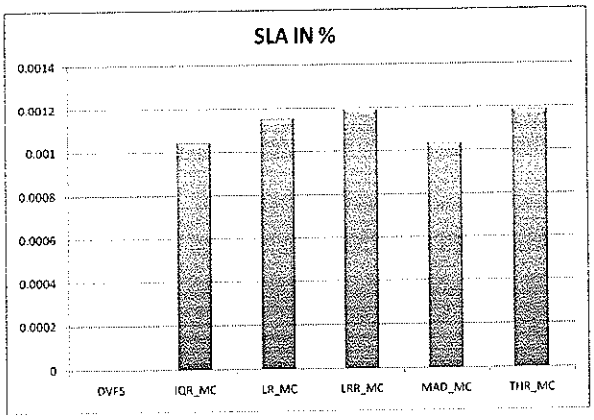

Figure 5 : Service Level Agreement Violation Graph

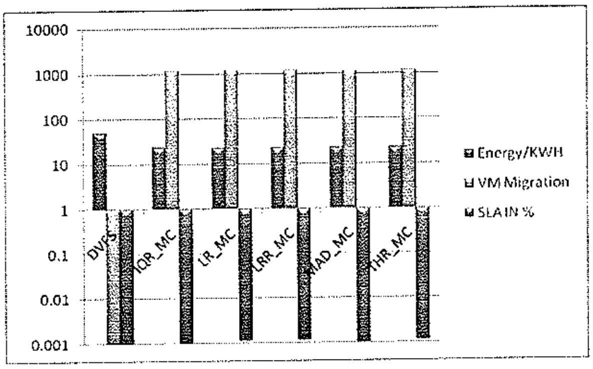

Figure 6 : Combine Graph

VII. Conclusion

In this paper, we propose a nature-inspired approach for solving the dynamic workload placement problem for energy-aware Infrastructures as a Service (IaaS) cloud computing environments. Using of Honey bee is implemented for Virtual machine placement in cloud environment. Simulation is done with 800 Host and 1052 VM for simulation clock of 24 hours. Experiment is implemented with various overload detection algorithm and minimum correlation policy with planet workload data. Experimental result shows that Honey bee with Overload detection of MAD policy and VM selection of Maximum Correlation policy gives less energy consumption, VM migration and SLA. This algorithm will give better QoS.

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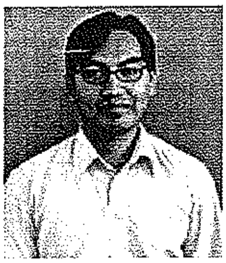

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