

Load Balancing Using Hybrid Soft Computing for Green Cloud Computing

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ABSTRACT: One of the hottest topics that is emerging in the field of IT is the 'Cloud Computing'. Some of the main characteristics of Cloud Computing such as loose coupling, strong fault tolerance, ease of use, business model, service oriented are excessively increasing the rate of cloud users. In spite of many of these advantages of Cloud Computing, its use is still a matter of thought because of some of its drawbacks, one of them being the over-consumption of the power. To overcome this drawback, dynamic load balancing method has been considered as an effective method. In dynamic load balancing, the dynamic consolidation of cloudlets over the VMs takes place. Since, dynamic consolidation is considered as NP-Hard problem, therefore, hybrid of soft computing algorithms is used for VM consolidation. The hybrid of Ant Colony Optimization (ACO) and Gravitational Search Algorithm (GSA) is used here to produce better results in terms of number of migrations and energy consumption. This hybrid is implemented using tool CloudSim embedded with Net beans.

KEYWORDS: Energy Efficiency, Green Cloud Computing /Soft Computing, Dynamic VM Consolidation, Hybrid.

I. INTRODUCTION

Cloud Computing has a glorious future. The increasing rate of use of internet and cloud technologies is the evidence of glorious future of cloud computing. Cloud Computing involves the storage and accessing of data and programs over the internet. It reduces the amount of hardware required, reduces the staffing needs, reduces cost. Cloud Based Systems are simple and easy to use because of its flexible and simple architecture. There is a rapid increase in the number of cloud users because of the reason that the services of cloud are available anywhere from the world. In the recent time, millions of people are using the services of the cloud due to its above mentioned features and benefits. Despite of all the above said benefits of cloud, there are some of its drawbacks too, one of them being the over-consumption of power. To decrease the power consumption, dynamic tasks allocation is being proposed in this paper which is considered to be NP-Hard problem. This problem can be easily tackled using the 'Soft Computing'.

Soft Computing has also been discovered as one of the efficient methods to reduce the power consumption in cloud. Soft Computing is used to solve the NP-complete problems. It includes the use of inexact solutions to solve the computational hard problems. These computational problems don't have any specific algorithms. So, soft computing is the best method to solve these NP-hard problems. Soft Computing can tolerate approximation, imprecision, uncertainty as well as partial truth. Soft Computing provides practicability. It not only provides robustness but also gives the low – solution costs. As compared to hard computing, it gives better results and it is tolerable to imprecision and approximation unlike hard computing.

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II. RELATED WORK

Farahnakian, Ashraf, Pahikkala [1], presented a novel energetic/changing Virtual Machine Consolidation approach named 'ACS-based VM Consolidation'. The energy use of datacenters is reduced by consolidation of VMs into a reduced number of active Physical Machines while preserving Quality of Service. They used the Ant Colony System to find a near-best solution because of the reason that VM Consolidation is strictly NP-hard problem. A multi objective function was defined by them that considered both the number of dormant PMs as well as number of migrations. ACS-VMC when compared to the existing dynamic VM Consolidation approaches, not only reduced the energy consumption but also reduced the number of migrations and minimized SLA violations. The performance of proposed approach was evaluated by conducting experiments with ten different real workload traces.

Shahzad, Umer, Nazir, [2] developed an efficient load balancing algorithm by using scheduling to minimize VMs migration, which avoid different network performance parameters like congestion, latency etc. Their work categorizes VMs by showing priorities of the VMs, which will help to reduce network overhead.

Zhao, Lu [3] developed online VM placement algorithms to increase cloud provider's revenue by reducing SLA violation cost. First-Fit and Harmonic algorithms are devised without considering VM migrations, while LRF and DDG are devised for VM migration considering VM migrations. Their analysis shows that First Fit and Harmonic perform the same in their worst case, and is comparable to the ratio of lower bound to upper bound. They have conducted experiments to evaluate the algorithms using synthetic and real data, respectively. It is found that Harmonic could create more revenue than First-Fit by more than 10 percent when job arriving rate is greater than 1.0. DDG algorithm is applicable in scenarios when SLA penalty is high, job arriving rate is low and the migration cost is low, while LRF performs better in the opposite situations. Through evaluation on the real trace from TJUHPCC, they find that First-Fit could yield more revenue than Harmonic by 1.7 percent if migration is not allowed, and DDG creates more revenue than LRF by 1.23 percent if migration is allowed. By comparing proposals against the algorithms adopted in Open-stack and Cloudstack, they find that FirstFit and DDG could create more revenue in the TJUHPCC case. Their algorithms currently could take effect in IaaS systems, where VM requests are not constrained by their communications.

Dhanoa & Khurmi, [4] have analyzed the impact of VM size and network bandwidth on VM migration time and energy consumption of the source system. Variation in VM size and network bandwidth results a significant impact on energy consumption of source system during VM Live migration. Further we can reduce energy consumption and migration time of subsystems by selecting VM with least memory size for migration and increased network bandwidth. Results of this study would help to design algorithm to optimize energy requirements in live migration of VMs. Live migration feature of Virtualization has great potential to optimize energy efficiency during live migration.

Vahora & Patel [5] Presents VM management technique for efficient utilization of resources which leads to reduce energy consumption and number of VM migration in virtualized data centers. There are number of research has been carried out in this subject, some are practical based and some are simulator-based. By analyzing related work on this subject, they found that it is critical and essential to handle three main things: first, how to allocate VM on host such that it is not over-loaded, second, which VM should be selected for migration from overloading hosts, third where to place (Reallocate) VM which is selected for migration. For this we have to balance the load such that host is not over loaded or under loaded with the requests. If host is over loaded one or more number of VM migrated from the host and if host is under loaded resources are not properly utilized which leads to unnecessary energy consumed by them. So, proper management of VM is necessary which is done by the algorithm and experiments shown that VM management techniques proposed by them performs greatly better than previous work on the whole.

III. PROPOSED ALGORITHM

We have used a hybrid of two algorithms, that are ACO(Ant Colony Optimization) and GSA(Gravitational Search Algorithm).

In ACO, the ants find the shortest path to their food from the source and to the source from the food with the help of excretion of pheromones. The best solution is chosen by the cooperative search. The shortest path is discovered by the group of ants collectively. Each ant excrete amount of pheromones and the path having the maximum amount of

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pheromones deposition is considered as the best solution or the shortest path. This is one of the Soft Computing algorithms. It, therefore, helps in solving the NP-hard problems. So, it is proposed to be used in our paper for dynamic VM-consolidation.

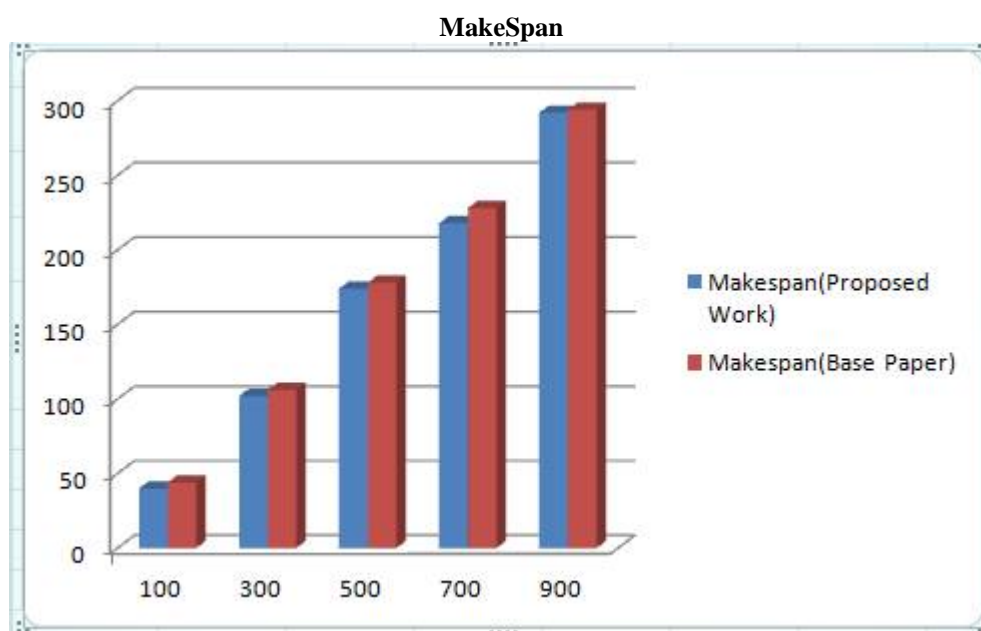
Gravitational search algorithm is one of the meta-heuristic algorithms. It is a local search algorithm. It is the result of inspiration of the Law of Gravity and masses interactions. In this algorithm, the collection of masses are the searcher agents. These agents interact with each other according to the Law of Gravity, also known as Newtonian Gravity and the Laws of Motion. Each agent has two properties, namely, position and mass. Position is the solution of the problem. The mass of the agents correspond to the performance of the solution. The agent with higher performance or say, higher gravitational mass has large effective attraction radius and hence greater intensity of attraction. Therefore, all the agents as a result move towards the agent with higher gravitational mass. And thus, this agent is considered as the best agent.

The pseudo-code for the algorithm is:

1. Start
2. Deployment of Virtual Machines(VMs).
3. Creation of cloudlets.
4. Calculation of mass and force (fitness function)of VMs and cloudlets.
5. Initial mapping of cloudlets over VMs using to GSA.
6. Creation of pools of Vms and cloudlets.
7. Mapping of cloudlets over the VMs using ACO.
8. View best solution.
9. Stop

IV. SIMULATION AND RESULTS

To evaluate the effectiveness of power consumption and makespan optimization strategy for cloudlets dynamic consolidation proposed in this paper, we employed two algorithms , ie, the hybrid of Ant Colony Optimization (ACO) and Gravitational Search Algorithm (GSA) .

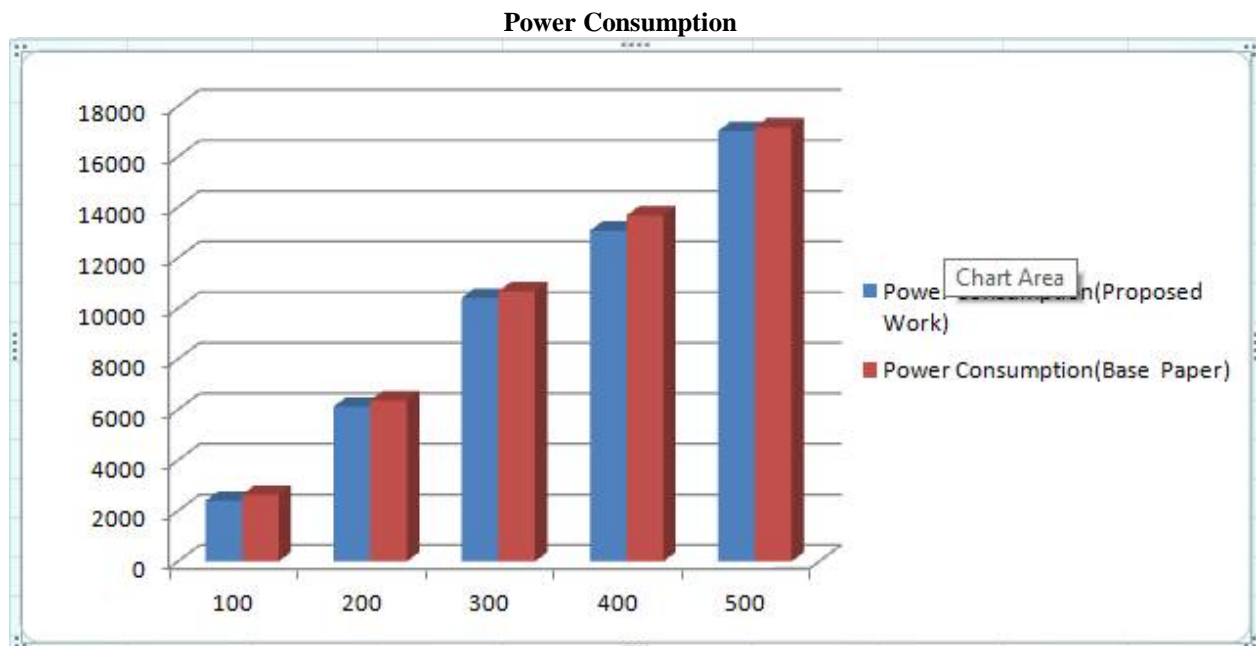


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V. CONCLUSION

In this paper, we present the dynamic task allocation over virtual machine according to the force and mass according to GSA to the power consumption in data centers of cloud models. Dynamic cloudlets consolidation is similar to bin-packing problem and it is NP hard. So, combination of two meta heuristic algorithms is efficiently used for cloudlets consolidation to reduce power consumption, reduce makespan as well as utilize the resources. In our future work, we will try to implement this hybrid of various algorithms for consolidation of cloudlets over VMs.

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