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Coherent Energy Utilization in Cloud Environment

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ABSTRACT

Dynamically allocating resources is one of the most effective ways of saving electrical energy in the cloud Environment. A combination of PSO (particle swarm optimization) and MSFLA (modified shuffled frog leaping algorithm), called PSO-MSFLA, is the proposed hybrid algorithm that can find optimal resource allocation configurations. Reasonable modification of the parameters is tedious in the PSO algorithm and typically takes a lot of time and effort. A self-adaptive structure is therefore proposed to improve the robustness of the PSO, and a new frog leaping rule is proposed to enhance the local exploration of the SFLA in the updated shuffled frog leaping algorithm (MSFLA) to improve the algorithm's efficiency. Using their benefits and avoiding their drawbacks is the primary concept of combining PSO and MSFLA. The proposed algorithm is tested in CloudSim and the simulation results show that the method proposed is very efficient and ensures that the global optimization is accomplished in a minimum time.

Keywords-Cloud computing, Virtual Machine, PSO, MSFLA, VM Migrations, Energy Consumption

I. INTRODUCTION

The dynamic distribution of resources in cloud computing has gained more interest from the academic community over the last few years. It is one of the most difficult resource management problems. Many scientists across the globe have come up with new ways to face this challenge. Due to the restriction of battery life, reducing energy usage has been one of the hot research topics in the field of cloud systems. In cloud computing, as there is no dedicated energy source, effective power management is a critical issue in such systems. High performance computing research has also recently implemented and developed a power-conscious platform to reduce total energy not only for running costs, but also for device reliability. The main aim is to reduce the energy consumed with little output degradation in the system. By using different combinations of scheduling algorithms, we will explore cloud computing based on reduced energy consumption approaches... [1] Beloglazov, Abawajy, and Buyya (2012) MBFD was applied to solve VMs' dynamic allocation problem. The algorithm, however, cannot achieve the dynamic consolidation of VMs with the full energy conservation required. [2]Lee and Zomaya (2010) in a distributed cloud computing environment, an effective energy management approach has been suggested. Based on the relation between task processing time and energy consumption, the researchers identified the optimized objective function as a relative superiority (RS) expression. The RS value for the task assigned is first determined. Then the job is assigned to the server with the maximum RS value. This algorithm assumes that all servers are working and running well and ignores the system's heterogeneity...[3] Kusic et al. (2009) The energy management problem in virtual heterogeneous environments was defined as a problem of scheduling optimization and minimal look-ahead control (LLC) during processing..[4] Verma, Ahuja, and Neogi (2008) In the virtual heterogeneous world, the energy-aware dynamic arrangements of VMs were modeled to solve the packing problem and re-allocated each time frame's VMs by live migration strategy.[5] Qi Zhang, Lu Cheng and Raouf Boutaba, In their Sandpiper system, load balancing in virtualized data centers using live VM migration was targeted. The main objective of the device is to prevent host overloads by detecting them and migrating overloaded VMs to less loaded hosts, called hot spots. The authors used an agnostic approach to the application, known as a black-box approach, in which VMs are observed from, outside without any awareness of VM-resident applications.

II. METHODOLOGY

A. Problem Statement

Providing stable QoS is one of the essential criteria for a cloud computing environment. SLAs that identify such characteristics as the minimum permitted throughput, the maximum response time or the latency provided by the deployed device can be described. While modern virtualization technologies may ensure isolation of performance between VMs sharing the same physical node, aggressive consolidation and workload variability can result in application performance degradation. Degradation of performance can result in increased response times, timeouts, or failures. Cloud providers therefore have to deal with the minimization of energy usage by energy efficiency trade-off, thus fulfilling the QoS criteria. Another challenge is that cloud technologies need massive data sets to pass between infrastructure and customers; it is therefore important to understand energy efficiency computing and network aspects. Energy use in large-scale computing systems such as Clouds poses many other problems, such as carbon emissions and system stability. Proposed algorithm challenges in relation to energy-efficient dynamic consolidation of VMs under QoS restrictions in IaaS environments.

B. Hybrid Method for energy saving

In this paper a new hybrid algorithm to choose the new placement of all scheduled VM. On account of applying the hybrid algorithm in run time, it has lower complexity and almost optimal solution that is got by Particle Swarm Optimization (PSO) algorithm that come together faster than other optimization algorithms. A particle swarm is a simulated population that is VMs, in which each VM can pass around the cloud and can be intrigued by the better positions. The function can take the location of the VMs and allocate a fitness value to the PSO fitness assessment function to determine the better and best positions. To change the allocation in the Cloud Sim, each VM has its own CPU, Ram, BW coordinate.

In the quest for food, the SFLA algorithm is based on memetic evolution inspired by a group of frogs. The SFLA algorithm combines the traits of the PSO algorithm based on social intelligence and the memetic algorithm based on genetic evolution. A population of frogs in SFLA means a set of candidate solutions. The group of frogs is split into several memeplexes, and various memeplexes represent different cultures. Since the frogs prefer to crowd around the best frog that could be a local optimum, in order to prevent convergence to the local optimum, some participants in a memeplex are called a submemeplex. The worst-positioned frog should evolve. Memeplexes are shuffled as a population after complex memetic iterations. The local process of searching and shuffling iterates until the solution satisfies the appropriate index or the generations of evolution are completed. Modified SFLA is implemented as:

- Swarm generation
- Memeplex partition
- Memeplex evolution
- Memeplexes shuffle
- Lowest fitness elimination

PSO, MSFLA and Hybrid algorithm were tested using cloudSim and the results were analyzed.

To endorse power and energy-aware simulations, we suggested MSFL, PSO and hybrid (combination of PSO+MSFL) algorithms using cloudsim. The main objective of an IaaS is to build an end-user view of infinite computing resources through proposed algorithms on a large-scale virtualized data center... It is incredibly difficult to experiment with repeatable, large-scale experiments on a real infrastructure. Therefore, discrete event simulation has been chosen as the initial way to test the efficiency of the proposed algorithms in order to ensure the repeatability and reproducibility of experiments, as well as to conduct large-scale experiments.

III. IMPLEMENTATION

A. PSO Implementation

The simulation cloud Platform was configured with more than 15000 hosts with VM IDs for the dynamic allocation of VM .Energy saving can be determined during the host overloaded/under loaded. The language used to explain the PSO follows from the analogy of particles in a swarm. These key terms are as following-pbest (personal best): the position in parameter space of the best fitness returned for a specific particle; gbest (global best): the position in parameter space of the best fitness returned for the entire swarm. The main function of our code in which gBest and gBest test are used as variables is PSO Algorithm. To compare the value of particle with its local value with the global value we used these names. First we generate all the particles to be used in the experiment using initialize () function.

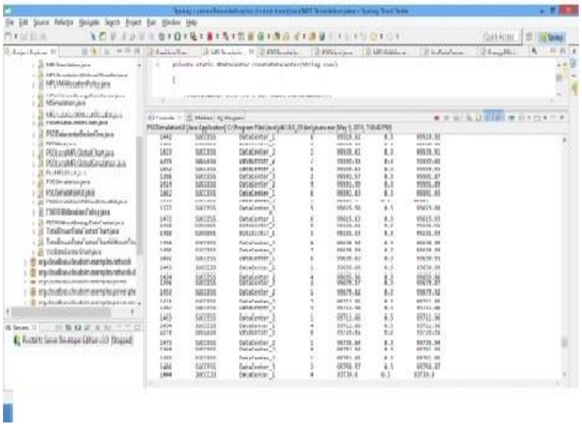

Figure 3.1 VM allocation using PSO

Then we run a loop with condition false to make checking of epoch with Max.epoch. We retrieve one by one particle id and make comparison between gBest and gBest test value by keeping the Target in mind and update the others as per the matching of the criteria. In the end we get the actual value of particle which can be match with the target. Dynamic allocation of VMs using PSO, during the job execution free and available hosts shown in the Fig.3.1.

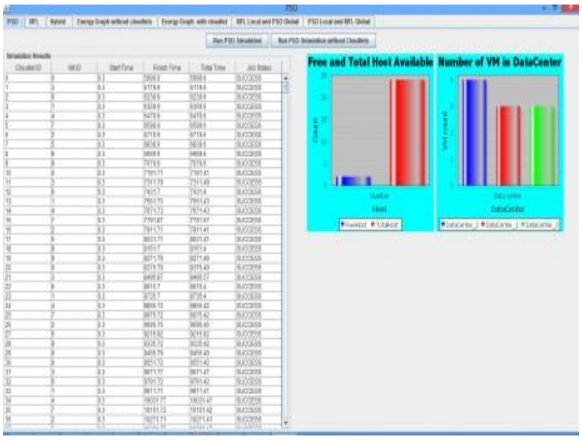

Figure 3.2 PSO Simulation

B.MSFL Implementation

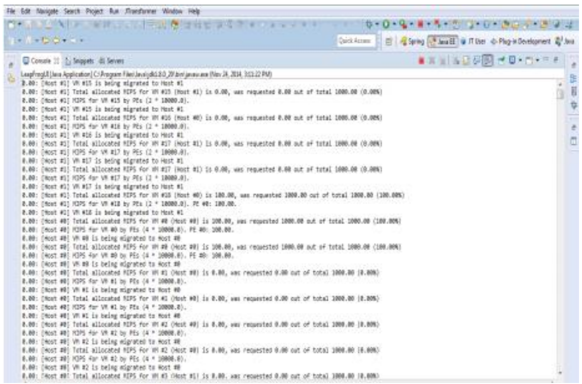

Figure 3.3 VM allocation using MSFL

This enables the user to build additional virtual machines. The number of Cloudlets Ci = {10, 20, 30...100} used by three datacenters and ten VMs are used before we receive all Cloudlets from the customer. The experiment will be performed with multiple host test scenarios and variations, VMs and cloudlets with VM allocation using MSFL, PSO and Hybrid will be analyzed against default data to see whether energy usage is decreased, increased or unchanged. The values discussed reflect the normal settings for hosts, VMs and cloudlets found in most data centers. **Host**

Max Power - 250 watts, Static Power - 70%, RAM - 10000MB, Storage - 1000MB

Virtual Machine

Number of CPUs – 1, RAM-2048MB, Bandwidth-1000 Mbps, Image Size -2500MB,MIPS rating - {250, 500, 750, 1000}

Cloudlet

Length – 40000, Number of CPUs – 1, File Size – 300, Output Size – 300

These are the criteria that the experiment will use to generate the results by doubling the value incrementally from the default value for the VMs, Hosts and Cloudlet until we hit the maximum value that a data center will cater for. Experiments will be performed, as mentioned above, increasing all values.

(i) Implementation results

This suggested MSFL algorithm is based on energy saving and dynamic virtual machine consolidation, which is implemented as follows

(ii) Migration of VMs

Energy saving can be measured when the host is overloaded/under loaded, but we can save energy during the shorter migration period.

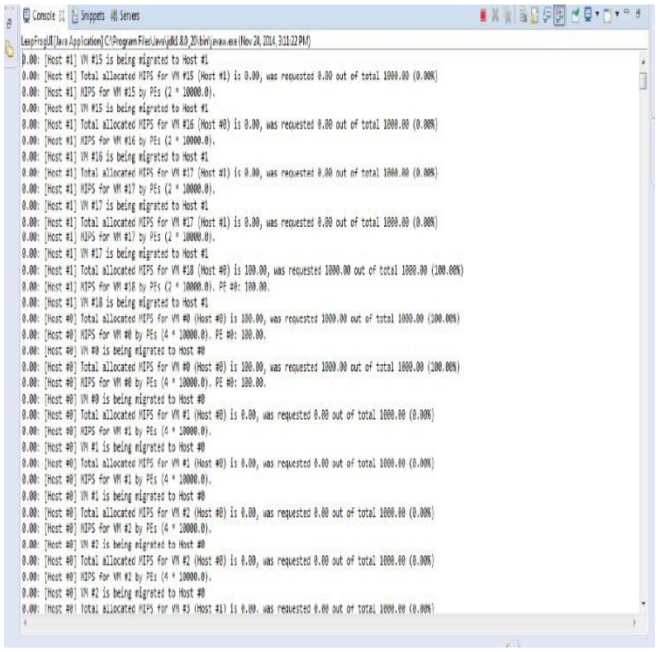

Figure 3.4 Migration of VM's

Figure 3.4 indicates that the virtual machine is allocated to the user without regard to power efficiency. Before that, we have to specify the number of users u_i in the cloud simulator where i=1,...,n user and then specify the user requests rh where h=1,..., a cloudlet technically referred to as cloudlet Cij. In which j=1,..M cloudlet and parameters such as cloudlet ID, length of cloudlet, PE number, size of cloudlet file, size of cloudlet output, user budget and deadline. Every host hw resides in datacenter dk where k=1, .,P datacenters within, host where w=1,.. ,b host, host. Parameters such as host ID, MIPS number, ram, bandwidth, and size are included in each host. The number of vc virtual machines inside the host where f=1,..,c vms are generated during runtime. And then schedule the clouds based on the values of the CPU and RAM parameters to be arranged in the queue. The virtual machine was then mapped to cloudlets in the cloud data center; the virtual machine it will assign to the cloudlet has been matched. It does not decrease power consumption in this production snapshot at all.

With the scheduling algorithm using MSFLA, energy saving can be measured in the graph below. We can compare the number of migrations without intelligent and smart algorithms, and energy savings can be measured.

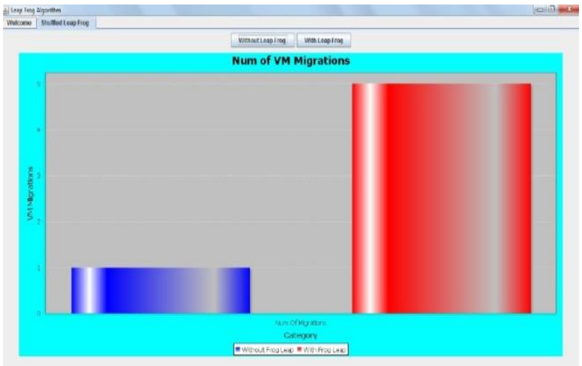

Figure 3.5. Scheduling Algorithm using MSFL

Dynamic allocation of virtual machines using the intelligent MSFL algorithm with energy savings in mind. Before that, we have to specify the number of users in the cloud simulator where i= 1, a mission. Technically, each task is referred to as cloudlet C_i, where i=1..,..m cloudlet. Parameters such as cloudlet id, length of cloudlet, PE number, and size of cloudlet file, size of cloudlet output, user budget and deadline are required. In datacenter dk, where within k=1, .,P datacenters, Every host hw is the host where w=1,.. ,b host, host. Each host includes parameters such as host ID, MIPS number, RAM, bandwidth, and scale. Inside the host, during runtime, the number of Vf virtual machines where f=1,..,c vms are generated. The generated VMs are then added to the MSFL algorithm and view the available hosts and free VMs in the datacenter shown in Fig. 3.5

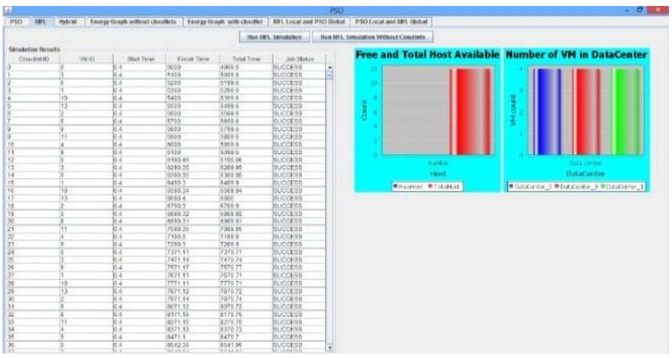

Figure 3.6 MSFL Simulation

In the proposed hybrid solution, an arbitrary VM is selected and tested for availability initially when a cloudlet is received for execution on VMs. Cloudlet is assigned to it if it is available. Otherwise, control keeps going through the VM list in a circular way until an available VM for cloudlet allocation is obtained. After cloudlet allocation, the next comparison takes place in the circular way at the next VM.

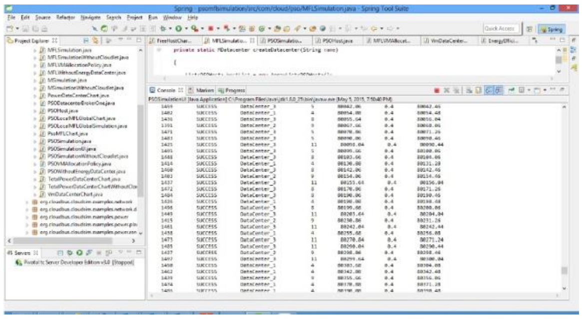

Figure 3.7 VM allocation using Hybrid algorithm

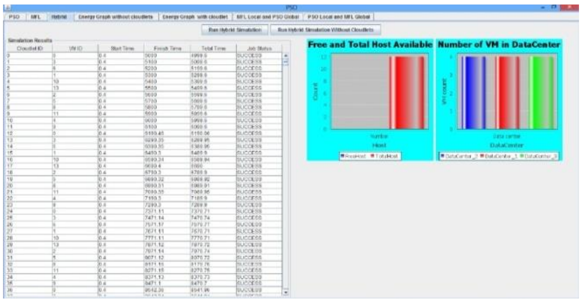

Figure 3.8 Hybrid Simulation

IV. PERFORMANCE ANALYSIS

CloudSim is used commonly to model and simulate the world of cloud computing. It is crucial to depend on a collection of input traces to accurately generate the workload in order to render experiments reproducible, which would enable the experiments to be replicated as many times as required. The traces include CPU usage info.

Usually, HPC applications are CPU-intensive with lower resource usage dynamics compared to web services, whose use of resources depends on the number of user requests and can differ over time. Due to unusual differences in resource usage, HPC workload is simpler to manage for a VM consolidation system. Therefore, the original workload traces have been filtered to stress the device in the experiments to leave only those that show high variability.

A.COMPARISON OF ENERGY CONSUMPTION BETWEEN MSFL VS PSO VS HYBRID WITHOUT CLOUDLETS

It is important to identify performance metrics that capture the relevant characteristics of the algorithms for successful performance assessment and algorithm comparison. The minimization of energy consumption by physical nodes is one of the targets of dynamic VM consolidation, which can be a metric for performance measurement and comparison.. Energy consumption is, however, highly dependent on the specific model and configuration of the underlying hardware, power supply performance, sleep mode implementation, etc

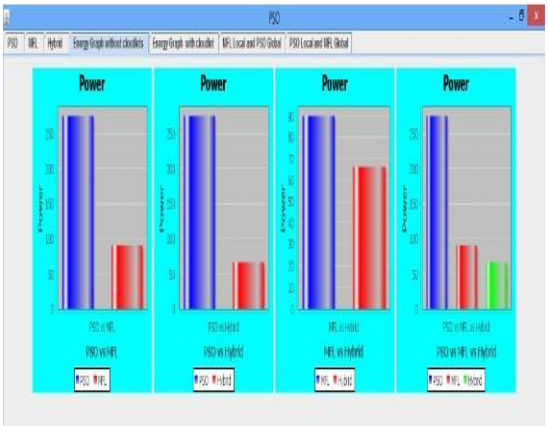

Figure 4.1 Comparison of MSFL,PSO and Hybrid before Job scheduling

The scheduling algorithm is intended to achieve the highest machine throughput and high performance computing. Scheduling monitors Processor memory availability and optimum resource usage is given by a good scheduling strategy. The time of a host being idle, aggregated over the full collection of hosts, is a metric that abstracts from the factors described but is directly proportional and can be used to estimate energy consumption. The quality of VM consolidation can be represented by the increase in the figure4.1 using this metric.

B. COMPARISON OF ENERGY CONSUMPTION BETWEEN MSFL VS PSO VS HYBRID WITH CLOUDLETS

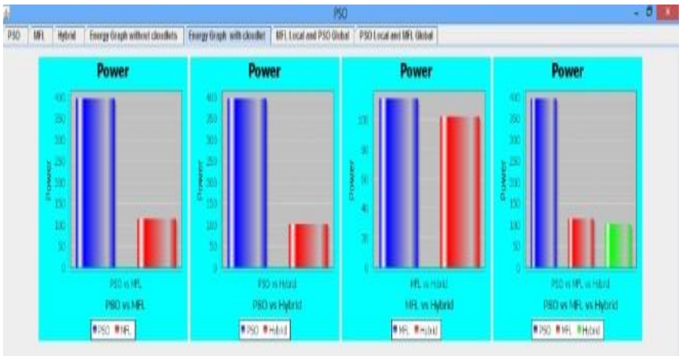

Figure 4.2 Comparison of MSFL,PSO and Hybrid after Job scheduling

However, this measure depends on the duration of the average evaluation cycle and the number of hosts. Aggregated idle time of hosts.

Comparative review of the presented method in terms of procedure execution with the current approach, which is not implemented before the deadline. This means evaluating the number of processes that after work migration are performed on other clouds.

The allocation of resources and resource scheduling has been a significant factor affecting networking, parallel, distributed computing and cloud computing performance. Many researchers have suggested different algorithms for the efficient allocation, scheduling and scaling of resources in the cloud. It is possible to generalize the cloud scheduling process into three phases, namely, –

A. Resource discovering and filtering
The Datacenter Broker discovers the network device tools and gathers status information relevant to them.

B. Resource selection
The target resource is chosen based on certain task and resource parameters. This is the stage to determine.

C.Task submission

Task is submitted to resource selected. Three scheduling algorithms PSO, MSFL and Hybrid have been discussed.

V. CONCLUSION

The difficult task is the complex allocation of virtual machines in cloud computing. We have presented the PSO, MSFL and Hybrid resource allocation algorithm that makes energy-efficient. During migration and when the host is overloaded or loaded, the proposed architecture reduces energy consumption. In order to assign the VM, the variables to be considered for price/deadline are also involved... According to the scheduling context and specified parameters such as processor, RAM, etc., the proposed algorithm allocates VM the performance depends on the utilization of the processor. The processor has great potential to save energy by slowing down the execution of the task and achieving SLA and QOS constraints when usage is limited. In science, business, social networking, and media content distribution, clouds have emerged as the next-generation IT platform for hosting applications... Energy-efficient management of cloud computing resources and, in particular, the dynamic aggregation of VMs addressed in this thesis would allow resource providers to effectively provide flexible service provisioning with lower energy, cost and CO2 emissions requirements..

In order to obtain more precise results for measuring the efficiency of energy-aware techniques, such as VM allocation in a real environment, the proposed methodology for doing experiments set up in a laboratory will be expanded in the future. We suggested, however, for VM allocation in open stack with three hosts in live environment, but we faced energy efficiency problem during migration. In order to analyze Processor and RAM behavior with various intelligent algorithms, our aim for future research is to continue performance analysis of cloud computing on various cloud platforms with various hypervisors.

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