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Energy Efficient Resource Allocation Using Hybrid Genetic Algorithm in Cloud

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Abstract

Cloud computing uses distributed servers organized in the web that is used to store, manage, and process information, rather than a regional web server or a laptop or computer. The cloud computing services are created available through the datacenters. The resources are most important consideration for energy consumption in data centers. Moreover power consumption within the cloud is proportional to the resource usage of datacenter which are nearly the world's maximum customers of power. So we have proposed to minimize the energy consumption through the clusters of server and VM migration using hybrid genetic algorithm in concern with efficient resource allocation. These two methods improve the energy efficient resource allocation in cloud environment.

Keywords: Cloud computing, energy efficient, resource allocation, clusters of servers, VM migration

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1 Introduction

The developing innovation of distributed computing offers virtualization models and new figuring models where assets, for example, online applications, registering force, stockpiling and processing foundations can be shared as administrations through the web [1]. The figuring model received by chiefly distributed computing suppliers (e.g., Microsoft, Google) is motivating highlights for clients whose request on virtual assets differs with time [2] . The cloud gives reasonable, on-request benefit, versatility, wide system get to, asset pooling and estimated benefit in profoundly adjustable way with insignificant administration effort [3].

Cloud programs are actualized in remote server farms (DCs) wherever high ability servers and capacity frameworks are found. A fast development of interest for cloud basically based administrations comes about into set up request of extensive server farms taking high amount of electrical energy Vitality proficient model is required for finish framework to decrease useful costs while keeping up vital Quality of Service (Qos). Vitality change will be accomplished by method for joining assets as with regards to the present utilization, green virtual system topologies and warm handling of registering equipments and nodes [4].

2 Energy Efficient In Cloud Environment

Energy efficiency has emerged as a special problem in large data center including cloud providers. The datacenter includes a large variety of internet servers also called as cloud Servers. Figure 1 explains the energy consumption through CPU utilization is that the key trouble in content circulation device.This will concentrate on most extreme dispensed frameworks (cloud systems) [5]. These fundamentals are improvement of arranged resourses collected from numerous corporate companies for increasingthe data centers. The consumption of CPU planned to reach out to Cloud server is used to create and estimate the utilization. [6].

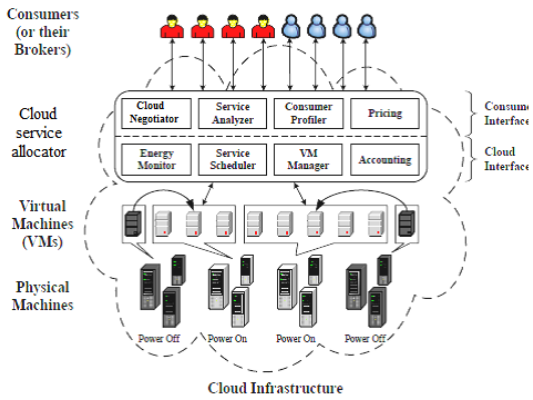

Fig. 1. Energy efficient in cloud environment

To improve the energy efficient in cloud environments that should follows some methods [7]. Such as

- Powering down -Switch off idle system for entire environment.
- Migration of VM – to transfer the virtual machine based on VM requests
- Clustering the servers – Energy scattering is fundamentally decreased by smartest Central Processing Unit (CPU) utilization and another collection of sectors, for example, storage, supply perpherals, arrange gadget and so forth additionally meet up permanently and in this way a Virtual Machine having CPU may at present utilize amount measure of Permanently. This step plans to reduce the vitality use as a whole at groups of servers while thinking about frameworks inertness and CPU utilization.
- Task union – This procedure to deals the energy framework by finding the least number of suitable framework to which the complete steps to be assigned.
- Virtual machine combination – This VM union is solid approach to advance the utilization of assets and their vitality productivity.Etc.,

We propose clusters of servers and virtual machine migration method using hybrid genetic algorithm in concern with efficient resource allocation. This system reduces energy consumption, arrival time and execution time.

3 Related Works

MehiarDabbagh [8] to propose one of the works in which vitality administration has been connected in cloud datacenter. In this work to estimate the arriving virtual machine (VM) request to the cloud data center

and provide exact physical machine(PM) to the cloud data center. This proposed work to reduce the energy consumption to the cloud datacenter by sleep the unused PMs. This work proposes three frameworks, such as data clustering, workload prediction and power management. These frameworks used analysis and observe the workload variation of the particular time. The data clustering method uses K-means clustering algorithm. This algorithm group the any type of VM request. Then power management method using BFD algorithm it calculate the PM utilization.

WannengShu [9] proposed the energy aware resource allocation for scientific workflow execution in cloud environment. This paper reduces the energy consumption of cloud platform using the energy aware resource allocation method. This method first analysis the idle virtual machines then migrate that virtual machine.

GirishMetkar [10] proposed the energy efficiency utilization in cloud environment.This paper use MADLVF algorithm to overcome the energy consumption and resource utilization of datacenter. This algorithm use VM consolidation method that reduces high energy consumption of datacenter.

4 Proposed Framework

The proposed framework in this paper using two methods such as the clusters of severs and VM migration method for diminishing the vitality utilization of the datacenter. The clusters of servers to group the virtual machine using the genetic algorithm and K-means clustering algorithm and VM migration algorithm used to migrate the VM. In these three algorithms it reduces the energy consumption of datacenter.

4.1 Hybrid Genetic Algorithm

The hybrid genetic algorithm includes the combination of genetic algorithm, K-means clustering algorithm and VM migration algorithm.The process of Hybrid algorithm is shown in the figure 2.

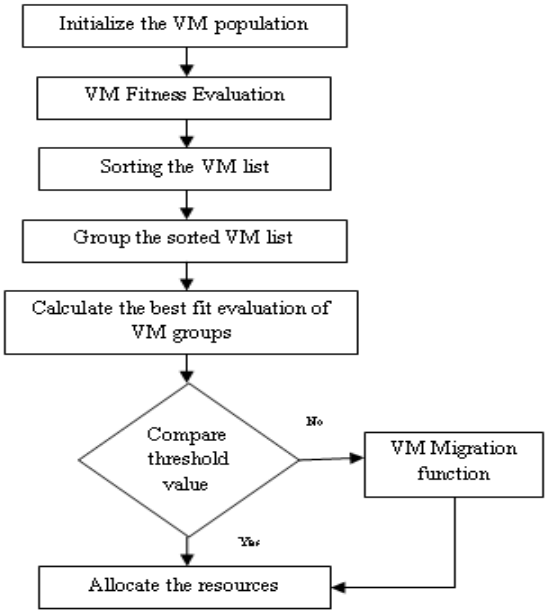

Fig. 2. Hybrid algorithm process

The genetic algorithm first initializes the population of virtual machine. Then, finds the fitness value for every individual virtual machine.After that sorting the VM list. The k-means clustering algorithm used to group the sorting virtual machines[11]. This grouping method to create k groups and that grouping is done by randomly select the values of the same fitness value as the highest and the lowest fitness value. Then evaluate the best fit virtual machine groups by comparing it to the threshold value. This value fit into the VM, then the resource can be allocated or if not fit into the VM, that the VM has been migrated after that resource has been allocated at the time the energy consumption of datacenter is reduce. This VM migration function is done by VM migration algorithm[12].

Pseudo for hybrid genetic algorithm

Input: No of Virtual Machine

Output: Migration of VM

1. Initialize the VM population {initialize VM list}
2. Evaluate the VM population {Evaluate VM list}
3. **While** total number of generation
4. Compute fitness value of individual
5. Sort the individual fitness value of VM list
6. **End while**
7. **For**
8. Random selection of VM {group the VM list}
9. Distance of random selection VM to another VM
10. **End**
11. **If**{Cluster group compare the threshold value}
12. Assigning the task for that cluster
13. **Else if**
14. Migrate the VM machine
15. **End**

5 Working Methodology

5.1 Initialize the Datacenter, Virtual Machine, Cloudlets

In this section has been creating the datacenters, brokers, virtual machines and cloudlets. The first step is initialize number of datacenter, then to display the datacenter names, id, host list, ram size, bandwidth etc., each datacenter have been own id, host list, ram size and bandwidth[13]. The datacenter is service provider of cloud environment. The second steps is creating number of brokers, that broker have been own id. The broker is intermediator of cloud providers and consumer. The third step is initializing the number of virtual machines [14]. The each virtual machine has been possess id, mips, slam, estimate, transfer speed. The virtual machine is the resource allocator in cloud datacenter. The final steps creating the number of cloudlets[15]. The each cloudlets has been own id, length, file size etc., the cloudlets is number of task or job for the customer.

5.2 Fitness Function

The selected set of virtual machine has been different attributes. So, we use the fitness function is used to find the best virtual machine in the selected set of virtual machines. The first step is initializing the every virtual machine, and then finds sum of total virtual machine and individual fitness value of virtual machine. This function equation is

Equation 1:

$$F(x) = \sum_{i=0}^{n-1} VM_i$$

Where,
F(x) = Total fitness value
n=No of Virtual Machines.

Equation 2:

$$F_i = \frac{VM_i}{F(x)}$$

Where,

i=(i=0,1,2…n)

$F_i(x)$=individual fitness value of VM

This sorting function is used to display individual fitness value of virtual machine in given order.

5.3 Clustering Function

Clustering function is used to group the set of spited virtual machine into the same group or different groups. It randomly assigns the centroid position of the one virtual machine, and then assign all virtual machines to nearest position of group. This function used to reduce the CPU utilization.

5.4 Migration Function

The migration function used to transferring virtual machine between the datacenter. This migration performed an automatic migration. The virtual machine placed on various group and datacenter, the need transfer and convert the virtual machine by various requirements.

6 Experimental Result

In this work to reduce the energy consumption of datacenter using energy efficient resource allocation based on clusters of servers method and VM migration method.

6.1 Simulation Toolkit

In this work done by eclipse-Luna software and another toolkit is cloudsim software. The cloudsim integrated with eclipse software. The Cloudsim an extensible recreation apparatus set that permits displaying and reproduction of distributed computing systems and application provisioning surroundings. CloudSim used SimJava as the distinct occasion simulator engine that facilitates several primary features, such as lining up and handling of activities, development of cloud computing system organizations (services, variety, data middle, agent, VMs), interaction between elements, and control of the simulator time.

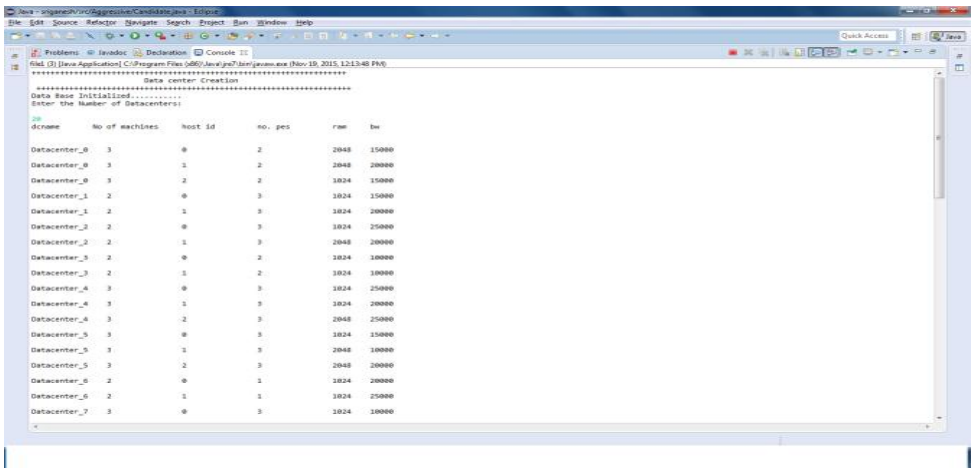

Fig 3. Initialize the datacenter, virtual machine, cloudlets

The initialization of Data center, Virtual machines and cloudlets are shown in the figure 3. It will initiated randomly through thecloudsim software.

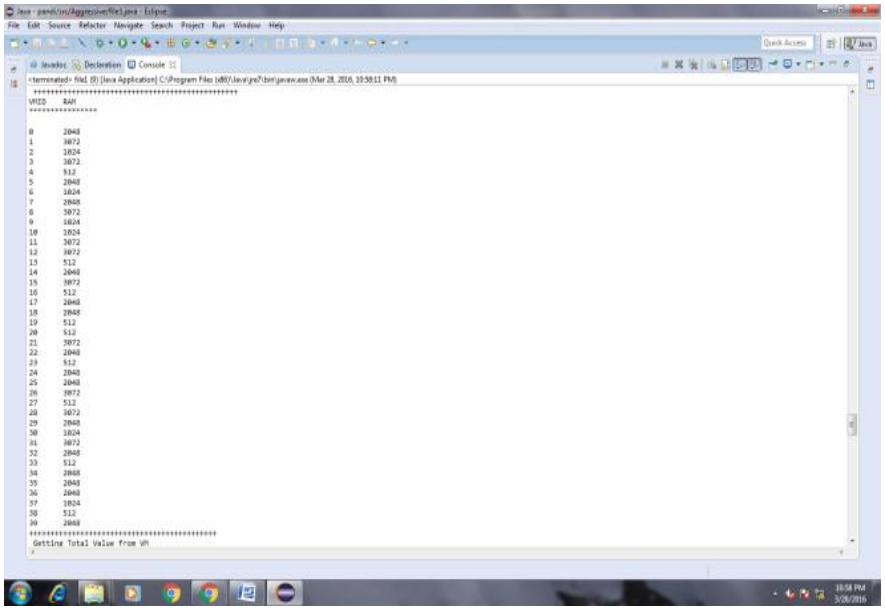

Fig 4. Fitness function

The fitness function is shown in the figure 4. The fitness function was chosen randomly through hybrid genetic algorithm. The fitness function for each virtual machine is dependent on number of cloudlets in the cloudsim software.

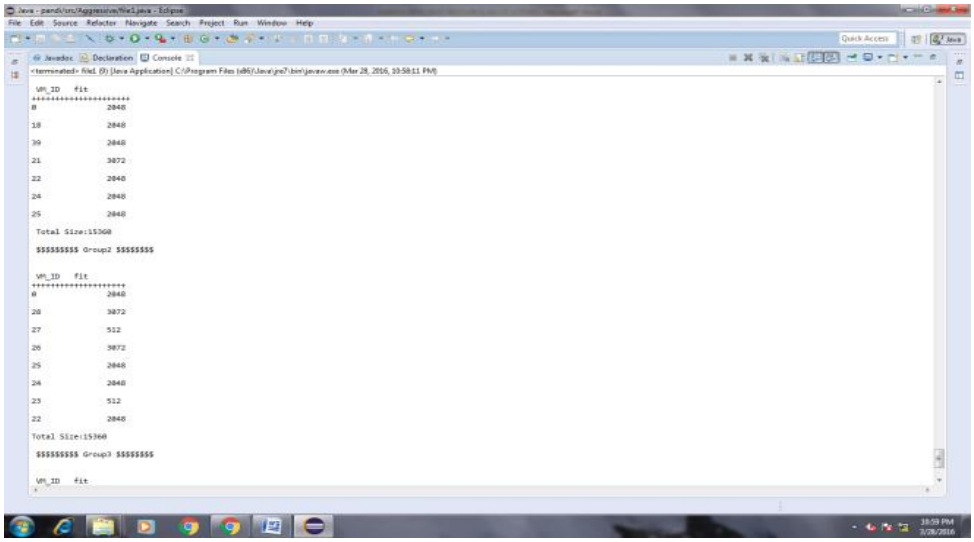

Fig 5. Cluster function

From the fitness function similar virtual machine functions were grouped as clusters. This will be calculated by the vector distance of each virtual machine through K-means algorithm. The cluster function was shown in figure 5.

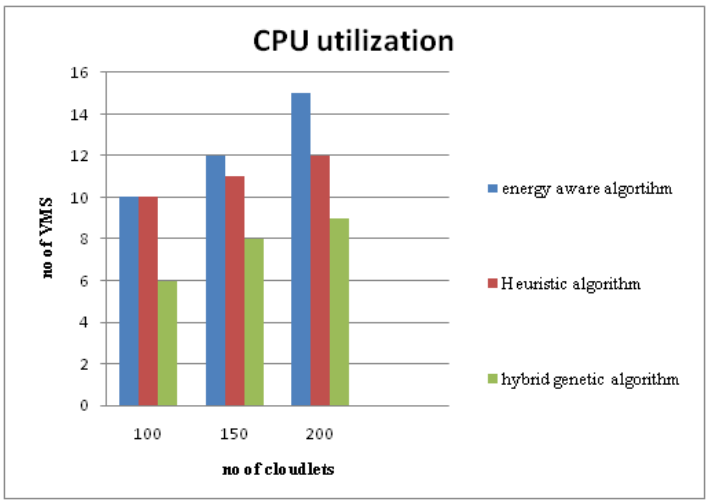

Fig 6. Comparison graph for number of VMs used in various algorithms for CPU utilization

The above graph clearly explains about allocation of cloudlets to the virtual machines. Here Hybrid genetic algorithm was compared with Heuristic algorithm and Energy aware algorithm. Its proved that Hybrid genetic algorithm hold less number of cloudlets when compared to other algorithms. So energy also saved through our research work.

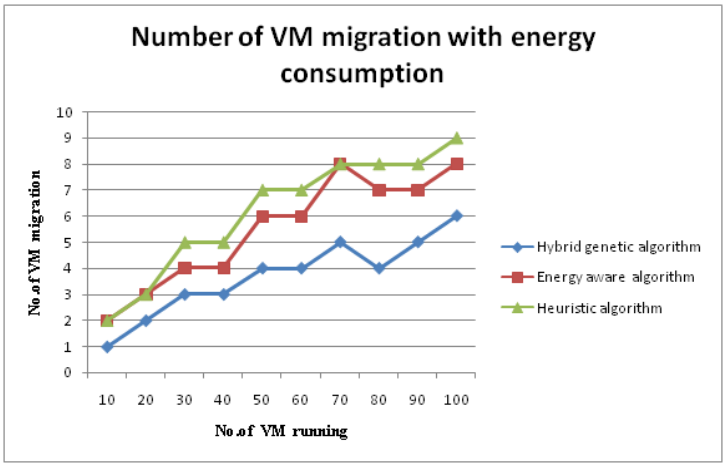

Fig 7. Comparison graph for number of VM migration in various algorithm for energy consumption

In figure 8 , Hybrid genetic algorithm compared with Heuristic algorithm and Energy aware algorithm for Virtual machine Migration. Virtual Migration is very low when compared other two algorithms. From this its clearly observed that Hybrid genetic algorithm uses very less energy compared to others.

7 Conclusion

The proposed system used to reduce the energy consumption of resource allocation in cloud using hybrid genetic algorithm. This algorithm uses two methodologies to reduce CPU utilization. The work will improve the energy efficiency of the particular system. In future work the particular methodology will implemented real cloud platform and satisfy various QOS requirements.

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Biographies

B. S. Murugan received the Undergraduate Degree (B. Tech) in Information Technology from Anna University, the Post Graduate degree (M.Tech) in Information Technology from SRM University, and Ph.D. in Information Technology (Cloud Computing) from Kalasalingam University. He has 12 years of experience in teaching and research. He has more than 25 publications in reputed journals and Conference proceedings.

Vinod D was born in Chennai, Tamil Nadu, and India in 1983. He completed his undergraduate degree in Bachelor of Technology in Information Technology with First Class at Anna University, Chennai, Tamil Nadu, and India in 2005. And he completed his post graduate degree in master of technology in computer science and engineering with First class with Distinction at Anna University, Chennai, Tamil Nadu, and India in 2009. And he completed his doctor of philosophy in information security at Sathyabama University, Chennai, Tamil Nadu, and India 2018. He presently working as an associate professor and the Research Group Head at Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India since 2019. His current research is focusing on information security

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