Energy Efficient Hybrid Policy in Green Cloud Computing

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Abstract: As we know Energy is crucial research in today's world. Due to emerging trends in technology, consumption of energy is growing independently but energy production capabilities are not growing as fast so, efforts to produce more energy is proving hazards for our environment that is usually becoming very important to adopt energy saving. Cloud is an energy hungry technology with data centre running hundreds of hosts. 24*7 energy consumption is very high. So, there is the need of study various techniques to reduce this energy consumption of the clouds and purpose an algorithm to reduce energy consumption. So, the objective of this paper is to study the energy efficient techniques in cloud computing and in this we proposed an energy efficient hybrid technique to lessen energy consumption in cloud computing. We will not only meet energy efficiency requirement but would also ensure quality of service to the user by minimizing the Service Level Agreement violation. We would also validate the proposed technique results with higher efficiency. The results of proposed technique/policy are compared with energy efficient cloud and power aware cloud.

Index terms: cloud computing, green cloud computing, data centers, energy efficiency.

1. INTRODUCTION

Cloud computing is made up of two things i.e. cloud and computing.

A Cloud alludes to a particular IT environment that is intended with the end goal of remotely provisioning versatile and measured IT assets [1]. It is a kind of figuring in which assets are shared instead of owning individual devises or nearby individual servers which can be utilized to handle applications on framework. Cloud is not just the most recent term for the Internet, however the Internet is an important establishment for the cloud, the cloud is something more than the Internet**.** "Cloud" makes reference to the two essential concepts I.e. abstraction and virtualization. Cloud provides services over the network i.e.

- Public cloud
- Private cloud
- Hybrid cloud
- Community cloud

cloud computing [2] passes on establishment, stage, and programming (applications) as organizations, which are made accessible to buyers as membership based administrations under the pay-as you- go model. In industry these administrations are alluded to as Infrastructure as a Service (laaS), Platform as a Service (PaaS), and Software as a Service (SaaS) individually. Cloud computing is the movement of anything as an organization as opposed to an item, whereby shared assets, programming, and data are given to PCs and different gadgets as a pay-as-you-utilize item more than a system (commonly the Internet).

There are certain technologies that are working behind the cloud computing i.e.

- Virtualization
- Service-Oriented Architecture (SOA)
- Grid Computing
- Utility Computing

As we know many cloud providers like Google, Microsoft, yahoo, IBM are rapidly deploying data centers in various locations around the world. Those data centers are not only expensive but also unfriendly to environment. To address this problem green computing concept comes which manage the data centre recourses in an energy efficient manner. Therefore green cloud computing solutions saves energy as well as operational cost.

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Green computing [3] is characterized as the study and routine of outlining , assembling, utilizing, and discarding PCs, servers, and related sub frameworks, for example screens, printers, stockpiling gadgets, and systems administration and exchange frameworks productively and successfully with insignificant or no effect on nature. Green computing is the eco-friendly utilization of PC's and related resources like physical hosts, virtual machines & CPU.

There are different approaches to green computing i.e.

- Algorithmic efficiency
- Resource allocation
- Virtualization
- Power management

As in cloud computing data is stored into the data centers. Data centers consume more energy and hence there is more CO2 emission. So, Developing cloud computing has caused data centers and consume lots of energy. Global warming has been a major concern recently, with high power utilization and CO2 discharge. Since energy has been a prime concern generally, this issue created the significance of green cloud computing that gives methods and calculations to reduce the energy consumption.

Related study

Norman Bobroff, et al. [4] this paper presents a management algorithm for dynamic allocation of virtual machines to physical servers is presented. The algorithm pro-actively adapts to demand changes and migrate the virtual machines between physical hosts thus providing probabilistic SLA guarantees. Time series forecasting techniques and bin packing heuristic are combined to minimize the number of physical machines required to support a workload. A method for characterizing the gain that a given virtual machine can achieve from dynamic migration is also presented. Experimental studies of the algorithm and its applicability using traces from production data centers are shown. The algorithm achieves significant reduction in resource consumption (up to 50% as compared to the static allocation) and also reduces the number of SLA violations.

Anton Beloglazov et al. [5] explained that modern Cloud computing environments have to give high Quality of Service (QoS) for their customers resulting in the necessity to deal with power-performance trade-off. Authors described an efficient resource management policy for virtualized Cloud data centers. The purpose is to constantly consolidate VM's leveraging live migration and switch off idle nodes to minimize power consumption, while providing required Quality of Service. Dynamic reallocation of VM's brings substantial energy savings, therefore justifying more development of the proposed policy. In this paper heuristics for dynamic reallocation of VM's to minimize energy consumption, while providing reliable QoS.

Rajkumar Buyya, et al. [6] this paper proposes CloudSim: an extensible simulation toolkit that enables modeling and simulation of Cloud computing environments. The CloudSim toolkit supports modeling and creation of one or more virtual machines (VMs) on a simulated node of a Data Center, jobs, and their mapping to suitable VMs. It also allows simulation of multiple Data Centers to enable a study on federation and associated policies for migration of VMs for reliability and automatic scaling of applications. Quantifying the performance of resource allocation policies and application scheduling algorithms at finer details in Cloud computing environments for different application and service models under varying load, energy performance (power consumption, heat dissipation), and system size is a challenging problem to tackle**.**

Anton Beloglazov et al. [7] explained that Cloud computing offers utility-oriented IT services to users universal. Based on a pay-as-you-go away model, it enables hosting of pervasive applications from purchaser scientific and business domains. As Data centers consume more energy and hence there is more CO2 emission. So, Developing cloud computing has caused data centers and consume lots of energy. Global warming has been a major concern recently, with high power utilization and CO2 discharge. Since energy has been a prime concern generally, this issue created the significance of green cloud computing that gives methods and calculations to reduce the energy consumption. in this paper they conduct a survey of research in energy-efficient computing and propose: Architectural principles for energy-efficient management of Clouds; Energy-efficient resource allocation policies and scheduling algorithms considering QoS expectations and power usage characteristics of the devices; a number of open research challenges, addressing which can bring substantial profit to together resource providers and consumers.

Rajkumar Buyya, et al. [8] in this paper, they define Cloud computing and provide the architecture for creating Clouds with market-oriented resource allocation by leveraging technologies such as Virtual Machines (VMs).They also provide insights on market-based resource management strategies that encompass both customer-driven service management and computational risk management to sustain Service Level Agreement (SLA)-oriented resource allocation.

Proposed Approach

In our proposed work, to reduce the energy consumption at cloud data center there are two policies we have used. The proposed work discovers a superior choice arrangement for the virtual machine to be relocated and discover an approach to choose which host will be chosen for reallocation of the virtual machine. The hybrid Vm selection approach and low utilization host selection policy will choose that which virtual machine will be picked for migration and which host will be chosen to reallocate that virtual machine.

Hybrid Vm Selection policy Algorithm:-

1. Analyze Vms on the host.

2. Find if the Vm on the host are migratable. If there are no migratable Vms return null.

3. Set first Vm cpu utilization and ram equal to minimum.

3. Find the CPU utilization and memory utilization of the Vm on the host.

If (CPU utilization >= minimum)

Compare CPU utilization and memory utilization with the previously stored Vm

If (CPU utilization of selected Vm< stored Vm) and (ram utilization of selected Vm< stored Vm)

Select Vm for migration.

4. Repeat step 3 till all Vmsare analyzed.

Low Utilization Host Policy Algorithim

After selecting the Vms to be migrated next step is to find the host on which Vms can be migrated. According to our research it is better idea to migrate VMs on the hosts that has low CPU utilization because if we will migrate VMs over a host that has high CPU utilization there are chances that we may overload the host and host may crash. Migrating Vms over low utilization host will reduce the chance of host overloading

1. Get the list of host to which Vm can be migrated.

2. Find the total utilization of the host.

3. If it is the first host in the list, store its utilization information, this information will be used as reference to compare with other hosts.

4. Compare the utilization of the hosts with the previous host; if the utilization of host is less than previously stored utilization info replace the utilization information.

5. Compare utilization of each host. In the end we will have host with lowest utilization.

6. Return host, this host will be selected for Vm migration.

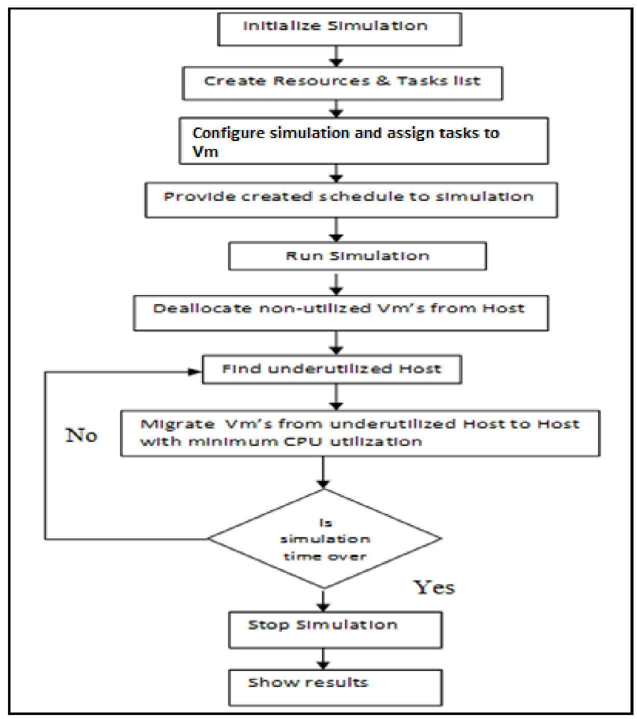

Fig 1.1: Flow chart of Proposed Algorithm

Experimental Results

The proposed work is implemented using CloudSim that allows simulate an energy aware Cloud model, that keep the track of its energy utilization. This is a java based simulator to simulate data-centers, hosts and virtual machines. In the experiment results, three scenarios are compares i.e. Energy Efficient Cloud, Power Aware Cloud and energy efficient hybrid Cloud.

The table 1: show parameter on the basis of which comparison is done.

S.No	Parameters	Energy Efficient Cloud	Power Aware Cloud	Energy Efficient Hybrid Cloud
	Experiment Name	Energy Efficient Cloud	Power Aware Cloud	Energy Efficient Hybrid Cloud
1	No. of Hosts	5	5	5
2	No. of VM's	10	10	10
3	Total simulation Time	1440.00 Sec	1440.00 Sec	1440.00 Sec
4	Energy consumptio n	0.03 kwh	0.05 kwh	0.02 kwh
5	No. of VM migrations	3	11	3
6	SLA degradation	0.09270%	0.01246 %	0.00158%
7	SLA time per active host	52.22%	8.01%	1.94%
8	No. of host shutdowns	4	4	4
9	StDev time before a host shutdown	159.82.07 sec	87.135 sec	8.04 sec

Table 1 Comparison of Energy Efficient hybrid Cloud with Others From the results it is clear the energy efficient hybrid Cloud results into reduction of energy consumption (.02 KWh) as compare with power aware Cloud and energy efficient Cloud. It also perform well in optimizing other parameters like energy consumption, virtual machine migration, SLA degradation (%), SLA time per active host (%), Standard deviation time before the a host shut down.

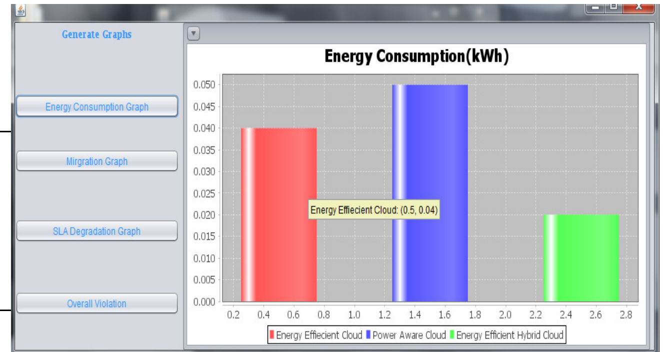

Fig 1.2 Energy consumption graph

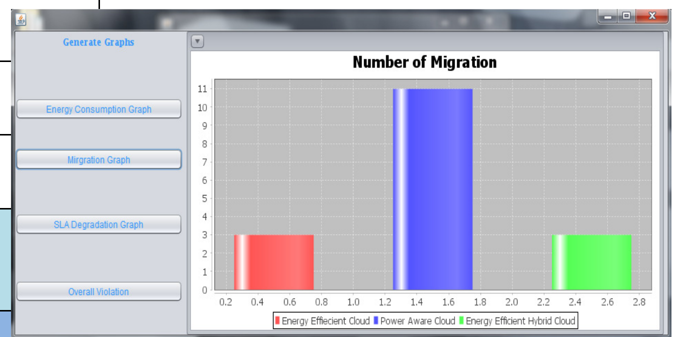

Fig 1.3 No of Migration Graph

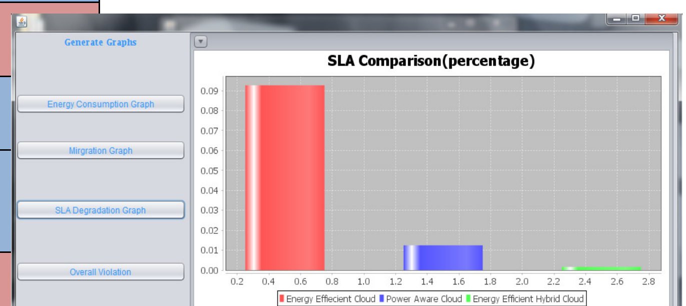

Fig 1.4 SLA Comparison Graph

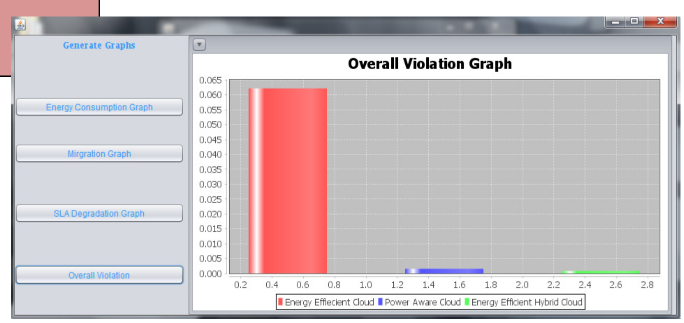

Fig 1.5 Overall Violation Graph

Conclusion

In this paper we proposed an energy efficient hybrid technique to reduce energy consumption in cloud computing. We will not only meet energy efficiency requirement but would also ensure quality of service to the user by minimizing the Service Level Agreement violation. We would also validate the proposed technique results with higher efficiency. Because energy has been a prime concern of late, this issue generated the importance of green cloud computing that provides techniques and algorithms to reduce energy wastage by incorporating its reuse. So In this paper we purpose a technique to reduce the energy consumption and CO2 emission that can cause severe health issues.

Future work

In the future work, there can be further study on energy saving optimization for live VM migration policy with such optimization processes that as many physical hosts as possible are shut down .There are many parameters for example we can take a parameter like network bandwidth. Through this we can reduce the energy consumption in future.
As future work, we can investigate several Cloud environments and propose new optimization policies which will minimize the CO2 emissions of Cloud environment, we will integrate energy cost rate into our new models in differing environmental impact and to minimize the total energy cost.

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