Energy Aware Load Balancing In Cloud Computing Using Virtual Machines

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Abstract
Cloud computing offers business-oriented IT resources and IT services delivery as a utility to users worldwide. The fast growing rate of the usage of large-scale data centers on cloud has demand for computational power. Datacenters hosting cloud applications consume huge amounts of electrical energy. As a result, the cost is assisting by energy consumption and cooling of the datacentre. It may increase overall investment on the computing. Therefore, minimization of energy consumption and balance the temperature of resources are a most important in Cloud Computing.

We are working on VM migration mechanism. The objective is reducing the energy consumption with thermal aware load-balancing in a Cloud center. Energy savings are achieved by continuous consolidation of VMs according to current utilization of resources and thermal temperature of computing nodes. In my propose work, we have considered the situation of over-utilization, under-utilization using resource utilization threshold and control temperature of the host using temperature threshold.

Keywords: Cloud computing, Datacenter, Virtual machine, Workload, Energy consumption

Introduction
Cloud computing is a new class of network based computing that take place over the internet. Cloud computing provides computing resources, from server or storage to enterprise application. Cloud computing serves as traditional client-server model as pay-as-you-go based utility model which delivers software, platform and infrastructure as services to users in the form of leases.

In a data center as per the client’s demand, host creates VMs which increase the load on the host. If the load of any host exceeds its capacity, then it affects their efficiency. If this imbalanced situation occurs due to over loading, then system is balanced using load balancing techniques by distributing the extra workload of the overloaded host machine to host having a light load thereby minimizing under or over utilization of available resources or VMs. For the systems to be most effective, any imbalance in the load should be sensed and mitigated as soon as they occur. Since the live migration process is used for Dynamic Load Balancing (DLB). A load balancing using live migration offers many benefits to an application, including higher throughput, reduced response time, minimize consumption of resource, adaptability, higher reliability to fluctuation in load.

The proliferation of Cloud computing has resulted in the establishment of large-scale data centers containing thousands of computing nodes and consuming enormous amounts of electrical energy. It has been estimated that in 2006 the energy consumed by IT infrastructure in the US was about 61 billion kWh, leading to 4.5 billion dollars in electricity costs [14]. Under current efficiency trends this is likely to double by 2014. The reason for this extremely high energy consumption is not just in the amount of computing resources used and the power inefficiency of hardware, but rather lies in the inefficient usage of these resources. Like cloud computing other high performance computing systems are concerned with energy consumption because powering and cooling these systems are very expensive, and consume a lot of resources. Moreover the energy consumption in the cloud is proportional to the resource utilization and data centres are almost the world's highest consumers of electricity [13]. Traditional technique such as cooling the data centre with the help of water or air is not sufficient for today's state of the art datacenter. Due to the temperature-balancing and the energy consumption has become key considerations across designing devices, software algorithms and efficient technology to design green cloud computing.

Another problem is the narrow dynamic power range of servers: even completely idle servers still consume about 70% of their peak power [8]. The cloud data center can reduce the total energy consumed through server consolidation or VM consolidation using the virtualization by workloads can share the same server and unused servers can be switched off. The total computing power of the Cloud data centre is the sum of the computing power of the individual physical machine. Virtual machines (VMs) are a logical exit of physical resources, and it is the heart of virtualization. In the datacenter, the number of host machines can be reduced using virtualization by consolidating virtual appliances onto shared servers. This can help to improve the efficiency of IT systems.

The remainder of the paper is organized as following. Section II gives brief introduction about VM migration and its benefits. Section III introduces the related work.
in load balancing and energy-aware algorithms. Problem statement defines in Section IV. Section V describes the concept of the proposed work. The paper concludes in Section VI with a brief summary.

VM MIGRATION
In VM migration transfer a virtual machine from one host machine to another host machine lively without disrupting the application running on it. Using virtual machine migration achieves:

a) Load balancing among the resources by distributing overall workload.

b) Minimize energy consumption by optimizing resource utilization of resources.

c) Avoid failure and improve the availability of the resources

The different virtual machine migration techniques are as follows [3].

Load Balancing Migration Technique
Using a load balancing migration technique distributes load across the physical servers in a datacentre. Dynamic workload in cloud datacentre manages by live migration of VMs. The Load balancing with VM migration gives benefits like, improve resource utilization, avoiding bottlenecks, enhancing scalability, avoiding over provisioning of resources etc.

Energy Efficient Migration Technique
The energy consumption of datacentre is mainly based on the utilization of the resources and their cooling systems. Any resources typically need up to 70 percentage of their maximum power consumption even at idle state. Management of energy consumption is most important in the cloud therefore need to migration techniques.

Fault Tolerant Migration Technique
If any part of the system fails during the execution of the job. Fault tolerance allows to continue it without any disruption. The virtual machine migrates from one physical machine to another physical machine based upon the prediction of the failure occurred, the fault tolerant migration technique is to improve the availability of physical machines and avoids performance degradation of applications.

Problem Definition
The work in [7][9] proposed VM scheduling algorithm that focuses on only minimizing the CPU usage not on the temperature of the CPU. The authors of [5] have considered CPU and temperature as a parameter to identify only overloaded host by using static threshold value. But fixed values for the utilization threshold are unsuitable for an environment with dynamic workload and unpredictable workloads, in which different types of applications can share a physical resource. The system should be able to automatically adjust its behavior depending on the workload patterns exhibited by the applications. So, need to auto-adjustment of the utilization threshold values.

Energy consumption does not scale linearly with the work load. The system uses a significant amount of energy even when idle or lightly loaded. It should be need to improve the efficient computing resource utilization and maximum minimization of energy consumption.
Proposed Work
We propose technique, which base on threshold values of resource utilization, temperature threshold values and VM consolidation. Resource utilization threshold values are calculated dynamically. Because, dynamic threshold is most suitable for dynamic workload. Using it improve the resource utilization so balance the workload more batter. Temperature of CPU calculated using a lumped thermal model which controls the heat of CPU. Using these thresholds identifies over loaded or heated hosts and under loaded or heated host. After that, using some ThaS[5] steps and VM consolidation to achieve the final goal. Show figures (1) defines the workflow diagram of our propose work.

Some steps of our propose work which defines the overall process of the work:

**Step 1:**
Show a figure of the initial state of the datacentre. In data centre have different host with the workload. There are different types of load in the host machine as CPU load, storage load, memory load, network related load, etc. Temperature of host also calculated using lumped thermal model. Initial state defines as in figure (2).

**Step 2:**
At the second stage calculate dynamic thresholds of resource utilization and define temperature thresholds. Resource utilization threshold values identify over/under loaded host machines. And, using a temperature threshold identifies high heated and low heated host machines to control the temperature of resources and save the unnecessary usage of energy. In figure (3) define these hosts.

![Fig 1. Flow of the propose work](image1)

![Fig 2. Initial state of Datacenter](image2)

![Fig 3. Initial state of Datacenter](image3)
Fig 3. Identify over/under loaded and heated hosts.

**Step 3:**

Fig 4. VMs migrate on appropriate target hosts and switch off idle hosts.

**Conclusion**

There are many challenges in cloud computing. But, load balancing and energy consumption is the biggest issue in cloud. Payment of a data centre for energy and cooling may be larger than the overall investment in the computing system. Therefore, minimize energy consumption with balancing the workload of resources is a hot topic not only cloud computing but also in other areas. The propose technique is suitable in dynamic workload and temperature balancing in a cloud environment. Our goal is to save maximum energy of the data centre. In this approach, we identify the dynamic threshold value of resource utilization and define temperature threshold. It reduces the consumption of maximum resources, control the temperature of the processor and maximum minimize the energy consumption.

**References**


