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RESOURCE MANAGEMENT BY VIRTUAL MACHINE MIGRATION IN CLOUD COMPUTING

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Abstract - Cloud computing is a quickly emerging field in computer science. It offers a wide variety of advantages over the traditional computing systems. Fast provisioning of resources, low upfront payment, minimal infrastructure management issues and so on. These enticing benefits offered by cloud computing has made it viable for many small organizations and keen individual developers as well. All of this cloud computing is possible with the help of datacenters running thousands of servers all through day and night, which means a lot of power is consumed by the servers alone. These datacenters in itself needs a lot of power for cooling, security and other essentials required to run a datacenter. All of this energy consumption by all of the datacenters worldwide means only one thing, a lot of carbon dioxide emissions, this carbon footprint can cause severe damage to the atmosphere in the years to come with this ever increasing need for cloud computing. All of the servers running in the datacenter are not necessarily running at full capacity, hence the cloudlets can be consolidated into a few servers whenever possible, so that servers that are being utilized below capacity can be turned into a less power consuming state and thereby overall reducing the cumulative power consumption of the servers in the datacenter.

Keywords – "CloudSim", "Green Computing"," Power Consumption", "Carbon footprint"

I. INTRODUCTION

Cloud computing is the latest buzzword in the computer science engineering field. From individual developers to large scale Enterprises, the preference for this latest technology is getting more and more by the day. Cloud computing is a computer paradigm where lots of servers are running at multiple places and each place is called as a datacenter. Large computer devices when run through day and night will certainly consume lots of power and as a result of this enormous usage of power will directly result in greenhouse gas emissions which does a lot of damage to the earth's atmosphere. One fact must be noted that most of the power generated to run these datacenters are from non-renewable energy resources. Until and unless we are harnessing energy from renewable energy sources such as solar energy, wind energy or any other form which does not damage the earth's atmosphere, it is left up to us to reduce these greenhouse gases by employing more efficient techniques which results in substantial lowering of the greenhouse gas emissions.

The aim of this paper is to bring forth technique for migration of cloudlets in servers in datacenter which will help reduce the power consumption of the datacenter. The cloudlets are migrated whenever multiple servers are in on state and these servers are being underutilized. By consolidating these cloudlets together into minimum number of machines whenever possible, when help turn the other underutilized servers into a less power consuming state, thereby reducing the power consumption at the datacenters and employing a more efficient technique for running a datacenter.

This journal is divided into subsections for ease of reading it. The sub sections are as follows. Background and related work, proposed technique, conclusion and references.

II. BACKGROUND and RELATEDWORK

Although cloud computing is a relatively old concept, the implementation and development in this field has rapidly picked up pace now more than any time before. However there are a couple of techniques that were proposed earlier for a more ecofriendly, green computing based methods in this cloud computing technology.

Ramon Mata-Toledo, Pranshu Gupta [1] have proposed a technique for converting current datacenter in green datacenter by first calculating the current power usage and then calculating the effectiveness of the power consumption. This is termed generally as "greenness". Also a new value called datacenter effectiveness is calculated, this value represents the actual effectiveness the current datacenter is having.

Here, the power usage effectiveness is calculated as the ratio of the entire datacenter building and the power used by the servers and all computer related equipment's.

Datacenter effectiveness is nothing but the invers of power usage efficiency.

Mueen Uddin, Azizah Abdul Rahman [2] have proposed a technique of categorizing the servers based on their usage within the datacenter. Servers are assigned for various types of operations and are used solely for that purpose only. The classification of servers is done into production, innovation and the servers for mission-critical operations. Each of these categories of servers are used to their full efficiency only during certain operations. For most part some servers are severely underutilized and results in overutilization of power. In this technique, the classification of servers based on its usage is made virtual and whenever the load on other servers used for other purposes increases, load is transferred to servers who usage is different from the current server. The threshold for transferring load from one server to another server is defined by the user.

In the proposed technique, to migrate the load/cloudlets from one server to another server we first have to install servers of different configuration i.e., different RAM, MIPS, Storage of the physical machines as well as the virtual machines. In this way we can separate servers which have higher processing rate from the ones which have moderate to lower processing capacity. This will help in migration of cloudlets/load based on the amount of computational resources it may need. By allocation the cloudlets/load to an appropriate server suitable for its processing we can control the amount of time which is required for its processing, thereby reducing the duration for which the server is used. By using the servers in this manner, we can reduce the overall processing time and the duration for which the servers are running at full capacity. Thereby significantly reducing the overall power consumption and carbon footprint.

III. PROPOSED METHODOLOGY

Algorithm:

1: Configure the basic simulation settings which includes the number of physical machines, virtual machines and the number of cloudlets
2: Within the components mentioned in step 1, configure MIPS, RAM, Storage and CPU of the individual components.
3: when the initial configuration is done, implement physical servers of various configuration i.e. each machine has various MIPS, RAM capacity. If there are large number of servers, then this configuration can repeat.
4: Virtual Machines are created, the configuration of this virtual machine was done in step 1.
5: Virtual machines are submitted to the broker.
6: Virtual machines are allocated to the physical machines in an order where the capacity of the physical machine is matched with the sum of all virtual machines allocated to it.
7: Cloudlets arrive randomly. Depending on the resources needed the cloudlet is migrated to a server better equipped to process it.
8: repeat step 7 until all cloudlets are processed.
9: Once the cloudlets stop arriving, consolidate all the cloudlets such that the total resources consumed by them is minimal
10: Turn the servers which are being underutilized at this point into a less power consuming state.

The proposed algorithm focuses mainly on creating an environment where the hardware, physical machine and the virtual machine are fully equipped to handle cloudlets/load of varying capacity. By reducing the overall computation time we are reducing the time for which the servers is being utilized to its capacity. Once all the computational tasks are done, the servers can be turned into a less power consuming state. Thereby reducing the overall power consumption and reducing the carbon footprint as well.

IV. EXPERIMENTAL SETUP

The proposed technique was tested via cloudsim framework written in java. This framework offers several benefits such as avoiding the huge costs to run this experiment on actual hardware, which is nearly impossible for students and academicians. Cloudsim simulated the proposed technique and results were analyzed. The general setup of the cloudsim framework is as follows.

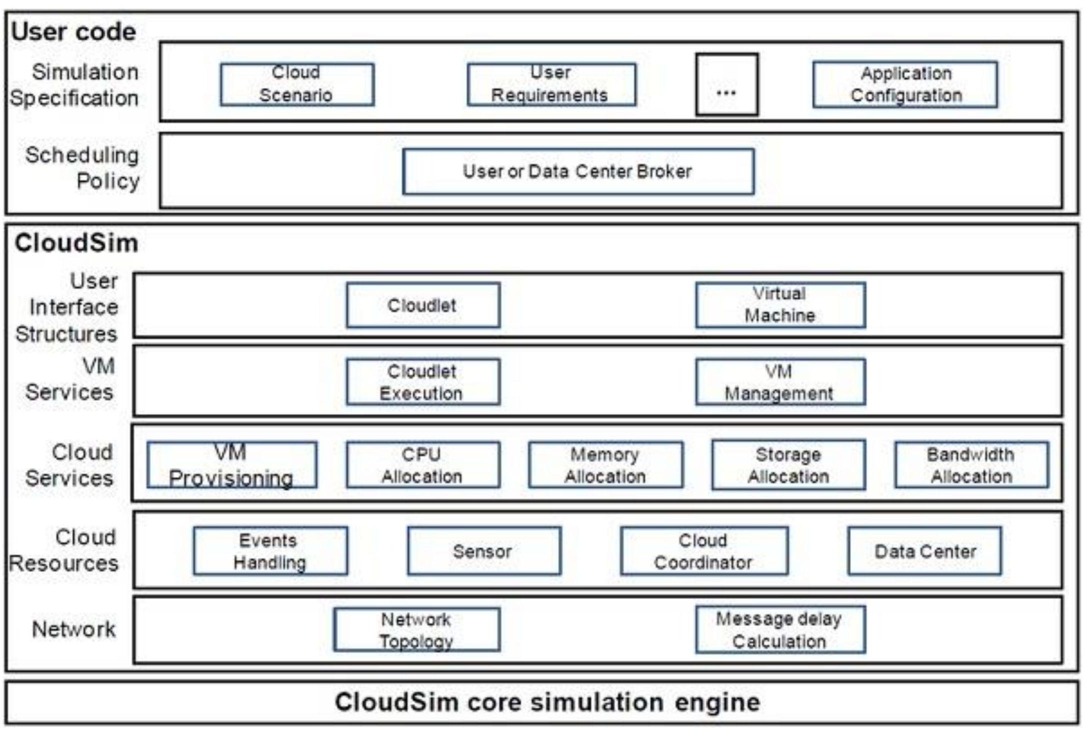

Figure 1: cloudsim architecture

A GUI was designed to rapidly test the setup by entering different configuration values for the cloudlets, physical machine, and virtual machine. An option to run and compare the proposed technique with other methodologies is given.

A snapshot of the designed GUI is as follows

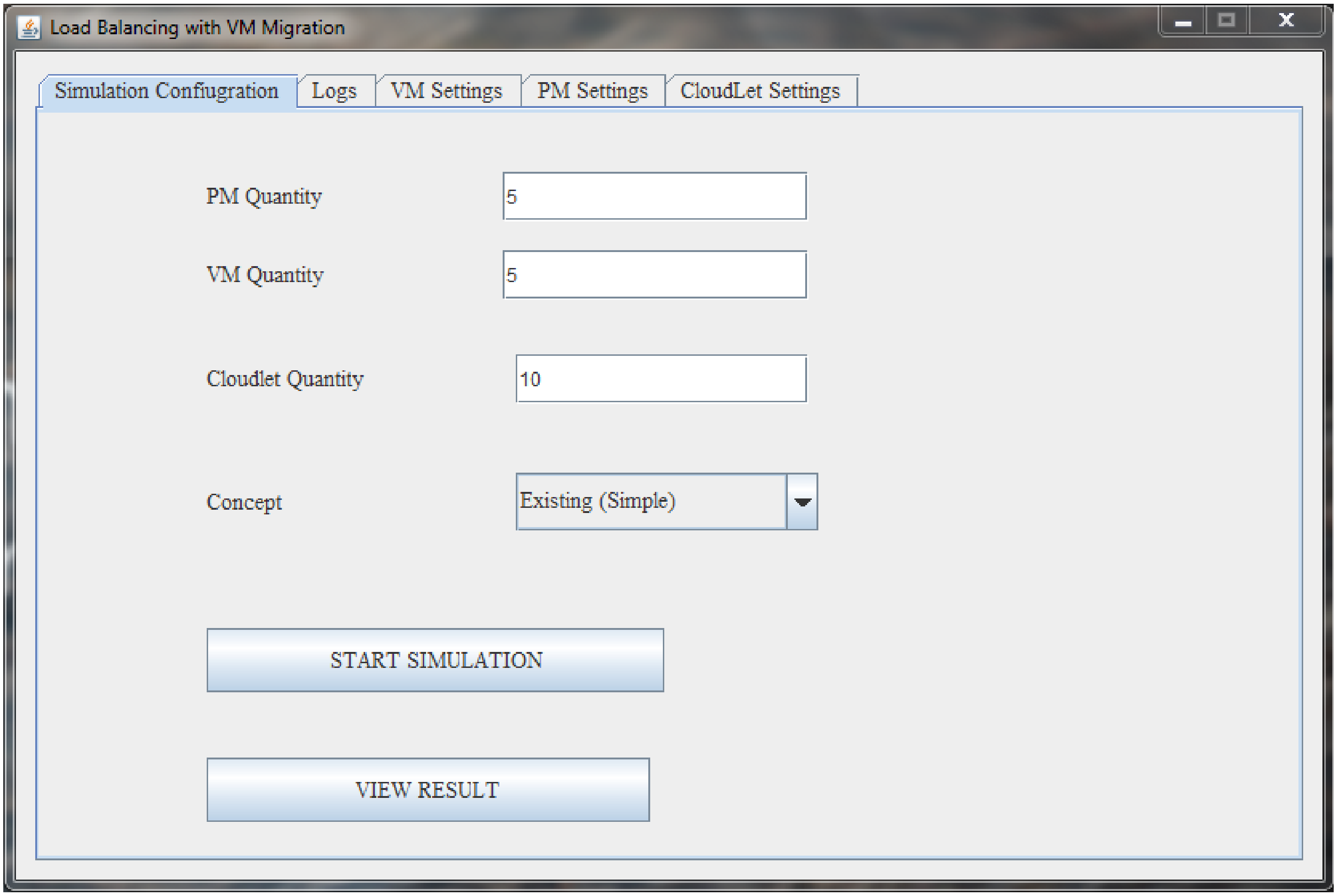

Figure 2: GUI for the setup

V. RESULTS AND ANALYSIS

The proposed experiment was carried out via the cloudsim simulator and a snapshot of the result is given below. Each cloudlet has the following attributes associated with it. Status, resource id, vm id, time, start time and finish time. Status indicates whether the task was executed successfully or not. Resource ID is the datacenter id which identifies the datacenter where the tasks are running. Virtual machine id identifies the virtual machine where the task was executed. Time is the total time taken for the execution of the cloudlet, this is in terms of milliseconds. Start and finish time denote the time at which the execution of the cloudlet started and the time when the cloudlet execution was completed.

The total time taken to process all of the submitted cloudlets is calculated and shown. Energy consumption in terms of KWH and W/h is calculated. The maximum available power is the energy required to run the servers, all of the datacenter to its full capacity. It indicates when the servers are running to capacity. Energy consumption in terms of percentage is calculated as ratio of energy consumed and the total available energy. Power/Time usage effectiveness is calculated and denotes the deciding factor on the effectiveness of the proposed algorithm.

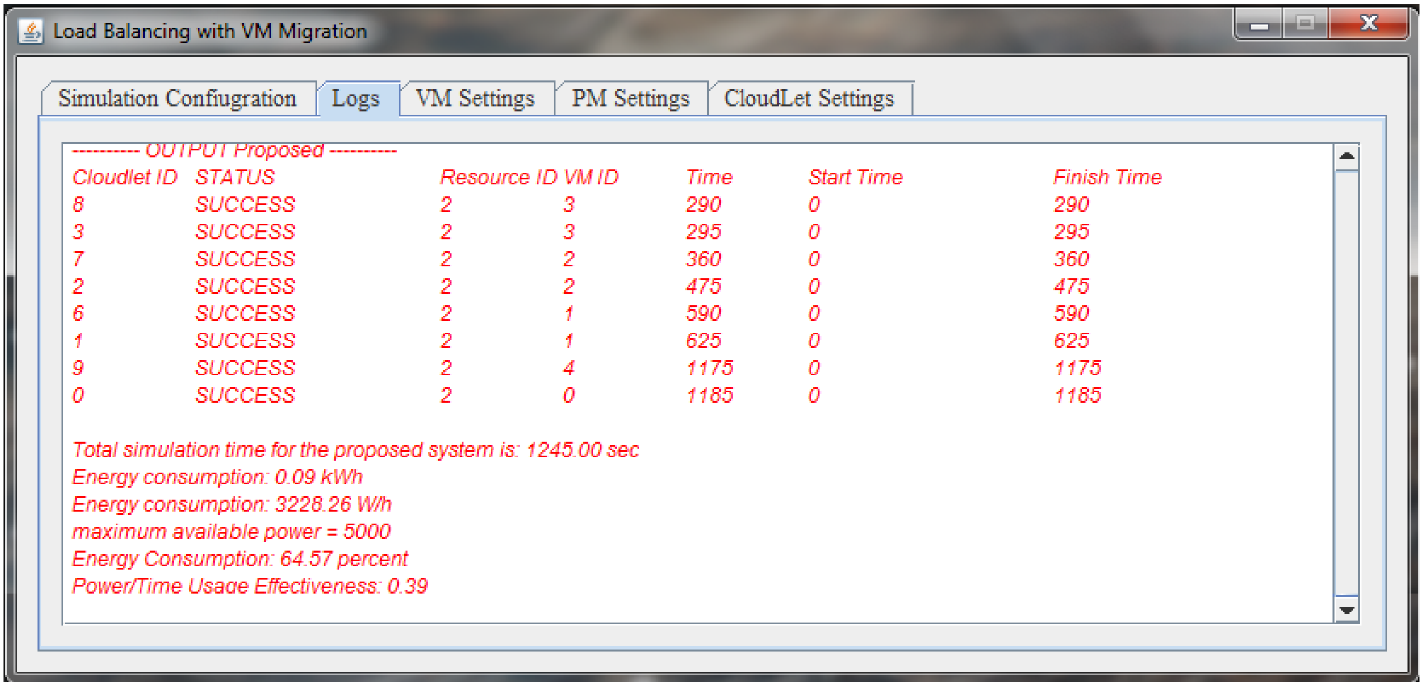

Figure 3: Results

VI. CONCLUSION and FUTURE WORK

This paper provides a way to reduce the power consumption by migration of cloudlets to appropriate servers. In future, each physical machine can be configured in such a way that it can dynamically increase or decrease its computational resources based on the cloudlets allocated to it at random. This reduces the need to migrate cloudlets and execute the cloudlets that arrive randomly to the server. This will help in even more faster execution of the cloudlets and thus reduces the total time for which the servers are to be running and reduces the power consumption and the carbon footprint.

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