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AN EFFICIENT ALGORITHM FOR ALLOCATING TASKS IN PRIVATE CLOUD USING GREEN COMPUTING APPROACH

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ABSTRACT

Green Computing is the practice of implementing procedures and policies that improve the efficiency of computing resources in such a way as to reduce the energy consumption and maintains environmental sustainability. Various existing scheduling techniques are there which manages load among the nodes but are not energy efficient for the Cloud computing platform. Aim of the thesis is to consolidate the load balancing in an efficient way so that the resource utilization can be maximized and the energy consumption of the data center could be minimized that can further result in reducing global warming and hence assist in achieving Green Computing

Keywords: Green Computing, Data Centers, Virtual Machine, Global Warming, Load Balancing

I. INTRODUCTION

Cloud Computing is an emerging technology that can support a broad-spectrum of applications. It is a new computing paradigm, where a large pool of systems are connected in public or private networks, to provide dynamically scalable infrastructure for data, application and file storage. Applications such as web conferencing, e-mail and customer relationship management (CRM), all run in cloud. Cloud Computing refers to configuring, accessing and manipulating the applications online. It offers online infrastructure, data storage, and application. It overcomes the platform dependency issues as there is no need install software's on our PCs. Hence,

II. ESSENTIAL CHARACTERISTICS OF CLOUD COMPUTING

On-demand Self Service: Cloud Computing have capabilities such as network storage, virtual machine can automatically use by a consumer without human interaction with cloud service providers.

Broad Network Access: Computing capabilities can be accessed over the broadband network using heterogeneous devices like phones, laptops, PDAs.

Resource pooling: Service providers pool their resources that are shared by multiple user. Resources are assigned and reassigned according to the demand of consumer. The physical may provide virtual machines, storage, processing, network bandwidth.

III. CLOUD COMPUTING SERVICES

Software as a Service (SaaS): SaaS can provide different software applications over internet, as a service on demand. It can be describe as an application Service provider (ASP). SaaS costing less money as there is no need to buying software licenses and it eliminates the load of installing, operating and maintaining of software in a computer.

Platform as a Service (PaaS): PaaS can provide all resources to build applications and services from Internet. It facilitates run time services for application design, deployment development and testing without the cost and complexity of buying and managing the underlying infrastructure. This platform consists of infrastructure software, and typically includes a middleware, database and development tools

Infrastructure as a service (IaaS): Infrastructure as a Service refer as the delivery of hardware (server, network and storage), and associated software (file system, operating systems virtualization technology), as a service. It is using Application Programming Interface (API) to interact with routers, hosts, and switches. Sometimes it also called as Hardware as a Service (HaaS).

IV. DEPLOYMENT MODELS OF CLOUD COMPUTING

Public Cloud: Public Cloud is the most common deployment model where all customers share the same infrastructure at the same time with limited security protection, configuration and availability variances. The advantage of the public cloud is that it can easily accessible to the public. In this model, authentication and authorization techniques are not used. Public cloud providers are Amazon, Google and Microsoft Azure.

Private Cloud: Private Clouds are deployed within an organization to provide IT services to its internal users. In private cloud there are no additional security regulations, band width limitations or legal requirements that can be present in a public cloud environment. It is more secure and expensive as compared to public cloud.

Hybrid Cloud: A combination of two or more cloud deployment models, linked in such a way that data transfer takes place between them without affecting each other. With a Hybrid Cloud, service providers can utilize 3rd party Cloud Providers in a partial or full manner thus increasing the flexibility of computing.

V. ADVANTAGES OF GREEN COMPUTING

Green cloud computing is a trend which has become popular with the emergence of internet driven services in every field of life. It refers to the prospective environmental advantages that computer based internet services can guarantee to the environment, by processing huge amount of data and information from collective resources pool.

VI. RESEARCH MOTIVATION

according to research of Google datacenter used about 2.26 million MW hours of power to operate in 2010, resulting to carbon footprint of 1.46 million metric tons of carbon dioxide.In other words, a single data center can consume power which is equal to a power consumed by small town. Green Computing is the practice of implementing procedures and policies that improve the efficiency of computing resources in such a way as to reduce the energy consumption and maintains environmental sustainability. Various existing scheduling techniques are there which manages load among the nodesbut are not energy efficient for the Cloud computing platform.Aim of the thesis is to consolidate the load balancing in an efficient way so that the resource utilization can be maximized and the energy consumption of the data center could be minimized that can further result in reducing global warming and hence assist in achieving Green Computing.

VII. LITERATURE SURVEY

YuyangPenget. al (2016) has proposed an evaluation energy efficient virtual machine allocation and genetic based algorithm based meta heuristic which support a power aware VM request allocation of multiple sustainable cloud data centers.

HuiguiRonget. al (2016) has reviewed the progress of energy-saving technologies in high-performance computing,energy conservation technologies for computer room and renewable energy applications during the construction and operation of data centers. From multiple perspectives of energy consumption and environment protection,

FahimehFarahnakianet. al (2015)has investigated the effectiveness of VM and host resource utilization predictions in the VM consolidation task using real workload traces. The experimental results show that the approach provides substantial improvement over other heuristic algorithms in reducing energy consumption, number of VM migrations and number of SLA violations.

Maurizio Giacobbeet. al (2015)has applied a new strategy to reduce the carbon dioxide emissions in federated Cloud ecosystems. More specifically, they have discussed a solution that allows providers to determine the best green destination where virtual machines should be migrated in order to reduce the carbon dioxide emissions of the whole federated environment.

MoonaYakhchiet. al (2015) has presented an approach based on Cuckoo Optimization Algorithm (COA) to detect over-utilized hosts. They have employed The Minimum Migration Time (MMT) policy to migrate Virtual Machines (VMs) from the over-utilized hosts to the under-utilized hosts.

ChenxiQiuet. al (2015) has stated the functioning of CSB (Cloud Service Brokerage) as an intermediary between tenants and cloud providers that can bring about great benefits to the cloud market. CSBs buy the cloud resources, i.e., servers, with lower prices from cloud providers and sell the resources to the tenants with higher prices

Yibin Liet. al (2015) has proposed a novel Energy-aware Dynamic Task Scheduling (EDTS) algorithm based on DVS (Dynamic Voltage Scaling) to minimize the total energy consumption for smart phones, while satisfying stringent time constraints and the probability constraint for applications.

YunNi Xiaet. al (2015) has presented a novelstochastic framework for energy efficiency and performance analysisof DVS-enabled cloud. This framework uses virtual machinerequest arrival rate, failure rate, repair rate, and service rateof datacenter servers as model inputs.

Mahesh b. Nagpureet. al (2015) has proposed dynamic resource allocation system which allocated resources to cloud user. The skewness algorithm measure uneven utilization of multiple resources of each VMs and accordingly balances across VMs.

S. Yakhchiet. al (2015) has proposed a novel power aware load balancing method, named ICAMMT to manage power consumption in cloud computing data centers. They have exploited the ImperialismCompetitive Algorithm (ICA) for detecting over utilized hosts

Yu-Wen Chen et. al (2015) has proposed a cloud based framework to provide a customer-oriented energy management as a service (EMaaS) for green communities, which are formed as virtual retail electricity providers (REPs) by involved DERs (Distributed Energy Resources) providers.

Anna AgustíTorraet. al (2015) has debated about the incentives that customers and data centers can adopt such measures and propose a new service type and pricing scheme that is economically attractive and technically realizable.

DoshiChintanKetankumaret. al (2015) has proposed a green cloud broker for resource procurement problem by considering the metrics of energy efficiency and environmental friendly operations of the cloud service provider. They have used mechanism design methods to decide the allocation and payment for the submitted job dynamically.

Shaoming Chenet. al (2015) has quantitatively analyzed the impact of server consolidation and temperature of cooling water on the total electricity and server maintenance costs in hybrid cooling data centers. To minimize the total costs,

Niangjun Chenet. al (2015) has focused on ‘‘greening’’ demand response in multi-tenant data centers by designing a pricing mechanism through which the data center operator can efficiently extract load reductions from tenants during emergency periods for EDR(Emergency Demand Response).

S.R. Sivarasuet. al (2015) has describedthat the regional renewable resources can effectively beutilized for powering the MG (Micro Grid) to supply fixed and deferrable loads.Communication between residential consumers during energy transfer through MG and communication between MG to utility gridis also emphasized.

Bharti Wadhwaet. al (2014) has proposed a new technique to reduce the carbon emission and energy consumption in the distributed cloud datacenters having different energy sources and carbon footprint rates. They have used the carbon footprint rate of the datacenters in distributed cloud architecture

Sonika P Reddy et. al (2014) has presented a system that handles real-time and non-real-time tasks in an energy efficient method without compromising much on neither reliability nor performance. Of the three processors, two processors i.e. the first and second, handle real-time tasks, using earliest-Deadline-First (EDF) and Earliest-Deadline-Late (EDL) scheduling algorithms respectively

Lucio A. Rocha et. al (2014) has stated a hybrid optimization model that allows a cloud service provider to establish virtual machine placement strategies for its data centers in such a way that energy efficiency and network quality of service are jointly optimized.

Samiran Roy et. al (2014) has proposed a green cloud enabled framework which envisioned the energy efficient way of a minimal discharge and rectification of the problem of high carbon production so as to increase the profit margin.

Yi-Ju Chiang et. al (2013) has discussed an efficient green control (EGC) algorithm for solving constrained optimization problems and making costs/performances tradeoffs in systems with different power-saving policies. Simulation results show that the benefits of reducing operational costs and improving response times can be verified

Md. E. Haqueet. al (2013) proposes an approach for High PerformanceComputing cloud providers to offer such a Green SLAservice. Specifically, each client job specifies a Green SLA, whichis the minimum percentage of green energy that must be usedto run the job.

Muhammad Zakaryaet. al (2012)discusses that organizations, industry, research laboratories and other academia to study and minimize the power requirements of digital and electronic devices especially the huge amount of computers in the global village.

AwadaUchechukwuet. al (2012) presents formulations and solutions for Green Cloud Environments (GCE) to minimize its energy consumption under new models by considering static and dynamic portions of cloud components, to reduce severe environmental impacts. To implement these objectives, an in-depth knowledge of energy consumption patterns in cloud environment is necessary.

BarkhaJavedet. al (2011) observed that datacenters consumes a lot of power and emits a large amount of carbon dioxide that contributes largely to global warming. The rise in global warming has elevated the need for datacenters to adopt such techniques and technologies that can be helpful to overcome the negative impact on environment.

John Lamb et. al (2011)describes power issues at data centers in South Africa based on the author's recent experience. The solutions to these power issues include virtualization of servers and data storage. Cloud computing has become the ultimate way to virtualize IT resources and to save energy

Hang Yuan et. al (2010) provides a comprehensive overview of the techniques and approaches in the fields of energy efficiency for data centers and large-scale multimedia services. They have highlights important challenges in designing and maintaining green data centers and identifies some of the opportunities in offering green streaming service in cloud computing frameworks.

B.Yaminiet. al (2010) focuses on reduction in energy consumption over the full equipment life cycle as the prime motivator for "green" application design; with energy reduction as the best measure of "green-ness". Green IT refers to the study and practice of using computing resources in an efficient, effective and economic way.

Zhengkai Wu et. al (2010)has proposed green computing in cloud computing due to its dynamic structure and property in online services, differs from current data centers in terms of power management

VIII. PROBLEM FORMULATION

The number of online services — such as search, social networks, online gaming and video streaming— has exploded. Due to data locality issues and the demand for fast response times, such services are usually distributed across geographically diverse set of data centers. This has led to the construction of large-scale computing data centers consuming enormous amounts of electrical power. Despite of the improvements in energy efficiency of the hardware, overall energy consumption continues to grow due to increasing requirements for computing resources. So, we investigate heterogeneous workloads of various types of Cloud applications and develop algorithms for energy-efficient mixing and mapping of VMs to suitable Cloud resources in addition to dynamic consolidation of VM resource partitions. After studying various papers and articles from different sources, we have come to know the various facts about the IT industry and the problems associated with it:

- Amazon.com has estimated that the energy-related costs of its data centres amount to 42% of the total budget that include both direct power consumption and the cooling infrastructure amortized over a 15-year period.
- In Gartner Report 2013, they have contributed that IT industry contributes 7% of world's total CO_2 emissions
- Just in the US alone, data centers are realistically responsible for about 50 million tons of CO_2 each year. The U.S. makes up ¼ of the totally energy footprint and, with current globalization trends, this ratio will continue to shrink.
- U.S. EPA Report 2013: 13.5% of total U.S. power consumption used by data centers which has more than doubled since 2010 and costs $14.5 billion.
- A typical data centre of a IT company consumes as much energy as 25,000 households.
- The total energy bill for data centres in 2010 was over $11 billion and energy costs in a typical data centre doubles every five years.
- Currently it is estimated that cloud servers consume 5% of the world's total electricity usage.

So, the aim of the thesis is to consolidate the load balancing in an efficient way so that the resource utilization can be maximized and the energy consumption of the data center could be minimized that can further result in reducing global warming. We have concluded the parameters that should be analyzed and improved that will result in reduction of global warming and will increase the profits of cloud provider and the client.

IX. OBJECTIVES

To improve the overall efficiency of the system, we have to reduce the power consumed at the IT data center in cloud environment. As we have already discussed, power consumption in the cloud is directly proportional to the electrical bills and thereby decreasing the margins and profits of the cloud provider and the client. Moreover, carbon footprints are also associated with the amount of power consumed. The main objectives of this research work are

- To implement and study the performance of existing load balancing and power saving algorithms.

- To design the improved load balancing algorithm with power saving architecture for proper allocation of tasks to the data center.
- To reduce the overall energy consumption and CO_2 emissions generated by the cloud datacenter.
- To reduce the overall cost of the client and the cloud provider and to increase the profits.
- To develop the proposed algorithm and compare the performance of proposed algorithm with existing algorithms.

X. METHODOLOGY

1. Initialize the cloud simulator with different capacities of virtual machines and cloudlets.

2. Assign the list of all virtual machines and cloudlets to data center broker.

3. Load balancing algorithm is applied.

4. Cloudlets will be allocated to virtual machines based on their instruction size, capacity and availability of virtual machines.

5. Virtual machine will be operate on different mode depend upon task nature and deadline.

6. Analyze the result for different no of workloads and virtual machine.

7. Compare results of proposed algorithm with existing algorithm.

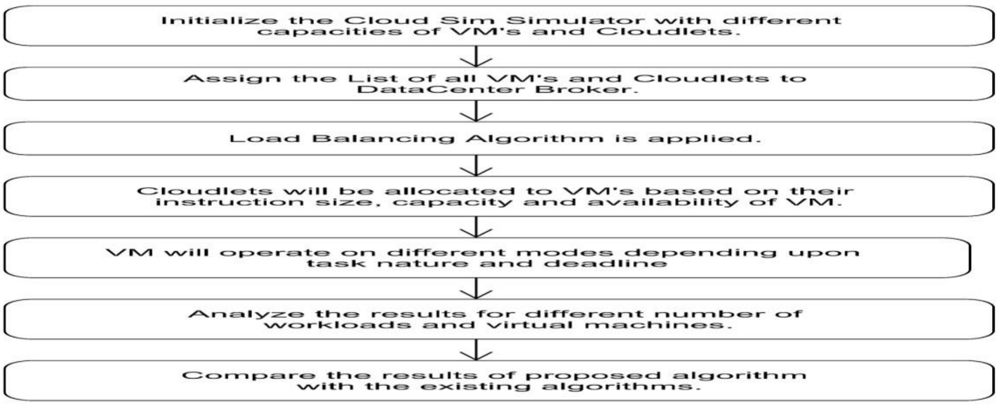

FIGURE: Flowchart of Proposed Methodology

XI. TOOL ENVIRONMENT

Cloud applications have different configuration, composition and deployment requirements. So, tool required to implement the workload consolidation technique on Cloud is described below.

- **CloudSim**

CloudSim is an extensible simulation toolkit that enables modeling and simulation of Cloud computing systems and application provisioning environments. The CloudSimtoolkit supports both system and behavior modeling of Cloud system components such as data centers, virtual machines (VMs) and resource provisioning policies. It implements generic application provisioning techniques that can be extended with ease and limited effort. Currently, it supports modeling and simulation of C loud computing environments consisting of both single and internetworked Clouds (federation of Clouds). Moreover, it exposes custom interfaces for implementing policies and provisioning techniques for allocation of VMs under inter-networked Cloud computing scenarios. CloudSim offers the following novel features:

- Support for modeling and simulation of large-scale Cloud computing environments, including data centers, on a single physical computing node.
- A self-contained platform for modeling Clouds, service brokers, provisioning, and allocation policies.
- Support for simulation of network connections among the simulated systemelements.
- Facility for simulation of federated Cloud environment that internetworks resources from both private and public domains, a feature critical for research studies related to Cloud-Bursts and automatic application scaling.
- Availability of a virtualization engine that aids in the creation and management of multiple, independent, and co-hosted virtualized services on a data center node.
- Flexibility to switch between space-shared and time-shared allocation of processing cores to virtualized services.

CloudSim Architecture

Figure 1 shows the multi-layered design of the CloudSim software framework and its architectural components. The CloudSim simulation layer provides support for modeling and simulation of virtualized Cloud-based data center environments including dedicated management interfaces for VMs, memory, storage, and bandwidth.

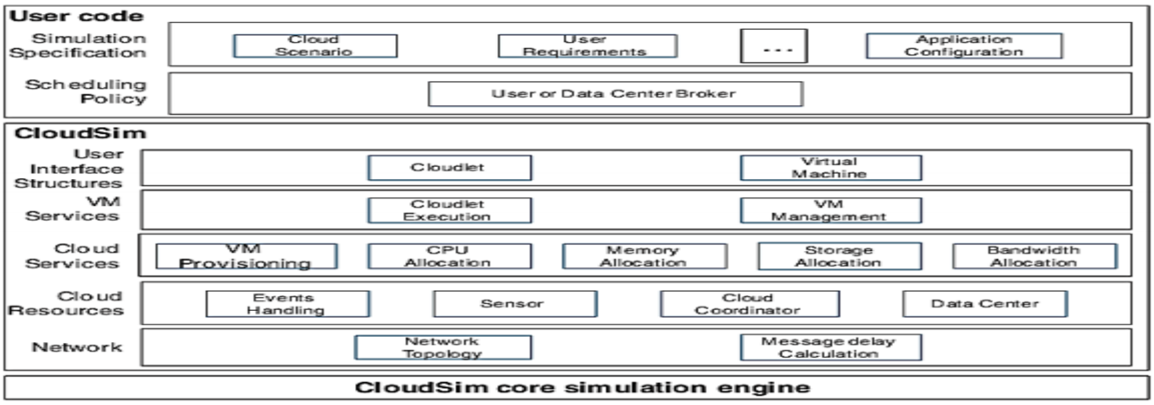

Figure 1 Layered Architecture of CloudSim

XII. CONCLUSION

Aim of the thesis is to consolidate the load balancing in an efficient way so that the resource utilization can be maximized and the energy consumption of the data center could be minimized that can further result in reducing global warming. We have concluded the parameters that should be analyzed and improved that will result in reduction of global warming and will increase the profits of cloud provider and the client.

XIII. ACKNOWLEDGEMENTS

1. NEERAJ SINGLA is PhD student in Guru Kashi University. He published more the n 10 papers in various journals. his area of interest is cloud computing.

2.VIJAY LAXMI is Dean of UCCA at Guru Kashi University. Her area of interest is cloud computing. She published many research papers in international journal.

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