International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 5 Issue: 5 1238– 1241

An Optimization of Energy Saving in Cloud Environment

N. Kalyana Sundaram[1], Dr. S.P. Rajagopalan[2]

[1]Research Scholar, School of Computer Science and Engineering, Vels University, Chennai.{hereiskalyan@yahoo.com}

[2]Professor, Department of Computer Science and Engineering, G.K.M.College of Engineering and Technology, Chennai. {sasirekaraj@yahoo.co.in}

Abstract:- Cloud computing is a technology in distributed computing which facilitates pay per model based on user demand and requirement. Cloud can be defined as a collection of virtual machines. This includes both computational and storage facility. The goal of cloud computing is to provide efficient access to remote and geographically distributed resources. Cloud Computing is developing day by day and faces many challenges; one of them is i) Load Balancing and ii) Task scheduling. Load balancing is defined as division of the amount of work that a system has to do between two or more systems so that more work gets done in the same amount of time and all users get served faster. Load balancing can be implemented with hardware, software, or a combination of both. Load balancing is mainly used for server clustering. Task Scheduling is a set of policies to control the work order to be performed by a system. It is also a technique which is used to improve the overall execution time of the job. Task Scheduling is responsible for selection of best suitable resources for task execution, by taking some parameters into consideration. A good task scheduler adapts its scheduling strategy according to the changing environment and the type of task. In this paper, the Energy Saving Load Balancing (ESLB) Algorithm and Energy Saving Task Scheduling (ESTS) algorithm was proposed. The various scheduling algorithms (FCFS, RR, PRIORITY, and SJF) are reviewed and compared. The ESLB algorithm and ESTS algorithm was tested in cloudsim toolkit and the result shows better performance.

Keywords: *Cloud Computing, Load Balancing, Task Scheduling.*

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I. INTRODUCTION

Cloud computing is a computing paradigm that enables the users to remotely store their data in a cloud, so as to enjoy services on-demand. It also describes a new Internet-based IT services to increase the use and delivery model, usually involving the Internet to provide dynamic and scalable and often virtualized resources. The main idea of cloud computing is to build a virtualized computing resource pool by centralizing abundant computing resources connected with network and present the service of infrastructure, platform and software. This network that offers various computing resources is called "cloud". It describes a category of on-demand computing services offered by cloud service providers, such as Amazon, Google, and Microsoft. This computing infrastructure is used by businesses and individuals to access applications from anywhere in the world on demand. Any cloud service provider offers computing, storage, and software "as a service".

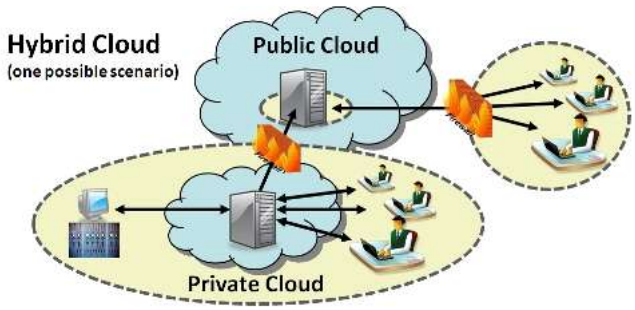

Fig. 1: Cloud computing infrastructure

Cloud computing accommodates provisioning and de-provisioning on demand and helps any organization in avoiding the capital costs of software and hardware. Cloud Computing is presented in three strategic business models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). Clouds provide services such as high performance computing, storage, and application hosting. Cloud providers are expected to ensure Quality of Service (QoS) through a Service Level Agreement (SLA) between the provider and the consumer. Cloud providers need to establish a robust infrastructure that

can grow dynamically, with easy maintenance and update. A cloud is a combination of physically and virtually connected resources. Virtualization allows us to instantiate virtual machines dynamically on physical machines and allocates them resources as needed; therefore, virtualization is one of the key technologies behind the cloud computing infrastructure. There are several benefits that we expect from virtualization, such as high availability, ease of deployment, migration, maintenance, and low power consumption that help us to establish a robust infrastructure for cloud computing.

II. RELATED WORK

Ibrahim Alzamil et al.[1] presented a paper as "Energy-aware profiling for Cloud Computing Environments". This paper proposes a system architecture that can be used for profiling the resources usage in terms of the energy consumption. From the profiled data, the application developers can enhance their energy-aware decisions when creating or optimising the applications to be more energy efficient. This paper also presents an adapted existing Cloud architecture to enable energy-aware profiling based on the proposed system. The results of the conducted experiments show energy-awareness at physical host and virtual machine levels.

Nidhi Bansal et al., [2] presented a paper "Cost performance of QoS Driven task scheduling in cloud computing". In this paper, the cost is calculated of QoS-driven task scheduling algorithm and compare with traditional task scheduling algorithm in cloud computing environment. The experimental results based on cloudsim3.0 toolkit with NetBeans IDE 8.0 shows that QoS-driven achieves good performance in cost parameter.

Sukhpal Singh and Inderveer Chana [3] presents "Energy based Efficient Resource Scheduling: A Step Towards Green Computing". In this paper, we emphasis on the development of energy based resource scheduling framework and present an algorithm that consider the synergy between various data center infrastructures (i.e., software, hardware, etc.), and performance. In specific, this paper proposes (a) architectural principles for energy efficient management of Clouds; (b) energy efficient resource allocation strategies and scheduling algorithm considering Quality of Service (QoS) outlooks. The performance of the proposed algorithm has been evaluated with the existing energy based scheduling algorithms. The experimental results demonstrate that this approach is effective in minimizing the cost and energy consumption of Cloud applications thus moving towards the achievement of Green Clouds.

Kejiang Ye et al.,[4] presented the paper "Virtual Machine Based Energy-Efficient Data Center Architecture for Cloud Computing: A Performance Perspective". In this paper, we study the energy efficiency from the performance perspective. Firstly, we present a virtual machine based energy-efficient data center architecture for cloud computing. Then we investigate the potential performance overheads caused by server consolidation and live migration of virtual machine technology. Experimental results show that both the two technologies can effectively implement energy-saving goals with little performance overheads. Efficient consolidation and migration strategies can improve the energy efficiency.

Anton Beloglazov and Rajkumar Buyya [5] described the paper "Energy Efficient Resource Management in Virtualized Cloud Data Centers" In this paper, we propose an energy efficient resource management system for virtualized Cloud data centers that reduces operational costs and provides required Quality of Service (QoS). Energy savings are achieved by continuous consolidation of VMs according to current utilization of resources, virtual network topologies established between VMs and thermal state of computing nodes. We present first results of simulation-driven evaluation of heuristics for dynamic reallocation of VMs using live migration according to current requirements for CPU performance. The results show that the proposed technique brings substantial energy savings, while ensuring reliable QoS. This justifies further investigation and development of the proposed resource management system.

Amlan Deep Borah et al., [6] explained the paper "Power Saving Strategies in Green Cloud Computing Systems". In this paper, various efficient energy saving Green IT methods are discussed. As cloud computing has become a fast emerging technology this days, some energy saving strategy for cloud computing has also been discussed in the paper. Most of the IT sector energy consumption happens in data centers. Virtual Machine migration an emerging energy aware technology used in data centers is also discussed in the paper. Finally some power conserving matrix parameters are given importance.

N.Ajith Singh and M.Hemalatha [7] elaborated the paper "Cluster based bee algorithm for virtual machine placement in cloud data centre". VM placement problem was examined in this paper with focus for maximum utilization of the resources and energy reduction. Switching off the idle server or in sleep mode can save energy consumption highly wasted in data centres. Technique for solving Virtual machine placement problem is implemented with the HoneyBee algorithm with hierarchical clustering in order to minimize energy consumption in servers. Cluster formation with the HoneyBee algorithm supports easy relocation of Virtual Machine migration and reduces the network latency. Further, simulation work with PlanetLab workload was

experimented and revealed that the proposed HCT algorithm reduced energy consumption significantly while reducing the SLA and VM migration.

Shivani Mankotiya, Abimanyu Bharadwaj [8] described the paper "A Study on Green Cloud Computing". The scope of this paper brings out the urgency and necessity to merge green computing with cloud, energy optimizing techniques and contributing analysis proposed by researchers in this field. The modus operandi to employ energy aggrandizement and green computing have been evaluated and embellished after meticulous cloud application and infrastructure analysis.

Kousik Dasgupta et al.[9] presented a paper "A Genetic Algorithm(GA) based load balancing strategy on cloud computing".

III. PROBLEM STATEMENT

The main problem is reducing the system performance in cloud. To improve the system performance, there is a need of task scheduling. Task Scheduling are service oriented and differ in different environments. Another problem is increase in energy consumption. To avoid this situation, we have to virtualize the servers, organizing and improve the stored data and Adjusting the temperature and humidity in data center.

IV. EXISTING SYSTEM

Energy-Efficient Resource Allocation Policies considering QoS expectations and power usage characteristics of the devices. Number of open research challenges addressing which can bring substantial benefits to both resource providers and consumers.

Disadvantages: i) SLA Violation is more. ii) Utilization Threshold is less.

V. PROPOSED SYSTEM

In this paper, we propose two methods: Load Balancing and Task Scheduling. Load Balancing can be defined as efficient distributing incoming network traffic across a group of servers. The functions of load balancing are distributes network load or client requests, high availability and reliability and flexibility to add or subtract servers. Task Scheduling can be refers to the set of policies that control the order of process to be performed.

Advantages: i) High performance and ii) Best system throughput.

VI. METHODOLOGIES

Energy Saving Load Balancing (ESLB) algorithm:

Steps:

1) Determine the load level Q_i for each processor.

2) If the maximum deviation d from equal distributions allowed in the system is given ($0<d<1$), then Q_i must satisfy the inequality: $1-d<=Q_i<=1+d$.

3) If the above inequality is satisfied for a processor, then the load assigned to it is acceptable (balanced load), else if $Q_i>1+d$, then the processor is overloaded.

4) If $Q_i <1-d$, then the process is underloaded.

5) Generate a new process graph and modified weight on communication links for reassignment according to the following:

i) If the load of P_i is acceptable, delete all the modules that assigned to P_i from the process graph.

ii) If P_i is overloaded, copy all the modules assigned to P_i from the original process graph.

iii) If P_i is under loaded, represent all the modules assigned to P_i by a single module.

6) Determine the new assignment such that all the processors are balanced and the communication costs are also minimized.

Energy Saving Task Scheduling (ESTS) algorithm:

Steps:

1) Sort task graph nodes into List L.

2) Assign j=1; j=j+1.

3) If j<N (total number of nodes) then calculate $t(V_j,s)$.

4) Check whether the duplicate conditions are satisfied.

5) If duplicate conditions are satisfied, then task duplication parameters are used.

6) If duplicate conditions are not satisfied, then check whether the task deadline is guaranteed or not.

7) If the task deadline is guaranteed, then use Schedule Vj on S.

8) If the task deadline is not guaranteed, the task migration parameters are used.

9) Repeat steps 5,6,7,8 until j<N.

VII. CONCLUSION

Load Balancing and Task Scheduling are the most important tasks in cloud computing environment. In this paper, we have analyzed ESLB algorithm and ESTS algorithm that are efficiently schedules the computational tasks in cloud environment. The FCFS algorithm, round robin scheduling Algorithm, priority algorithm and shortest job first algorithm were also reviewed. Priority is an

important issue of job scheduling in cloud environments. By using the cloudsim toolkit, both the ESLB algorithm and ESTS algorithm were compared. The performance evaluation of both ESLB algorithm and ESTS algorithm shows better result.

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