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Improving Energy Efficiency through Load Optimization in Cloud Computing

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ABSTRACT

Cloud computing offers utility-oriented IT services to users worldwide based on a pay-as-you-go model. It also enables hosting of pervasive applications from consumer, scientific, and business domains. However, data centers hosting Cloud applications consume huge amounts of electrical energy, contributing to high operational costs and carbon footprints to the environment. Therefore, we need Green Cloud computing solutions that can not only minimize operational costs but also reduce the environmental impact. A virtualization technology is a promising approach to consolidating multiple Virtual machines (VM) onto a minimum number of servers to improve energy efficiency of server. Dynamic VM provisioning, VM consolidation, and switching servers on and off as required, through all these techniques data centers can sustain the required Quality-of-Service (QoS) while accomplishing higher server utilization and energy efficiency. In this paper I conducted a survey of research in energy-efficient computing and proposed an algorithm that will play vital role in improving energy efficiency of the data center.

Keywords: Energy Efficiency, Load Optimization, Cloud Computing

I. INTRODUCTION

Cloud computing delivers an infrastructure, platform, and software as services that are made available to consumers in a pay-as-you-go model. In industry these services are referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) respectively. To deliver Cloud computing services many computing service providers including Google, Microsoft, Yahoo, and IBM are rapidly deploying data centers in various locations around the world. For complete realization of Cloud computing, Cloud service providers have to ensure that they can be flexible in their service delivery to meet various consumer requirements and keeping the consumers isolated from the underlying infrastructure. Recently, high performance has been the main objective in data center deployments. This demand has been fulfilled without paying attention towards energy consumption of data center. Therefore there is a need to change the focus from optimizing resource management for performance to optimizing them for energy efficiency, with maintaining high service level performance. VM consolidation is widely used approach for consolidating running VM in minimum number of host and putting underutilized host in to power saving mode to lower the energy consumption of the data center. In this paper we conducted literature review about various methods for optimizing energy efficiency as well as proposed VM placement algorithm based on regression process for placing VM on available host. Rest of the paper is organized as following. In section II related work is given section III describes about proposed work and in section IV conclusion and future research direction is given.

II. RELATED WORK

No.	Paper Name	Proposed work	Advantages	Limitations/ Research Gap
1.	Consolidation of VMs to improve energy efficiency in cloud computing environments[1]	VM placement algorithms based on FFD, PABFD, GPABFD method.	Reduces energy consumption to some extent.	Have to solve the problem of VM placement, including ant colonies optimization, dynamic programming and sharing aware algorithms.
2.	MuMs: Energy-Aware VM Selection Scheme for Cloud Data Center[2]	Proposed MuMs: Energy-Aware VM Selection Scheme	Helpful to minimize the electric energy consumption and reduced the SLA violation of the cloud data centers.	Algorithm can be applied to larger data centres.
3.	Power Aware Resource Virtual Machine Allocation Policy for Cloud Infrastructure[3]	P ARAP (Power Aware Resource Allocation Policy) algorithm	Maximize utilization of resource, improves energy efficiency	Parameters for quality of services and throughput can be included.
4.	Energy Aware SLA and Green Cloud Federations[4]	Green Cloud Federation Algorithm	reducing the energy consumption to some extent	Affect the privacy since the sharing of resources, security measures have to be implied.
5.	Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing	MBFD and MM algorithm	Improves energy efficiency also considering Qos and SLA.	More work is required to develop a platform that supports the energy efficient management.

III. PROPOSED WORK

Various advanced concept such as future forecasting of resource requirement, virtual machine consolidation and live migration, server consolidation can be applied to improve energy efficiency and better result can be obtained. Consolidation of virtual machines is one of the key strategies used to reduce the power consumption of Cloud data centers. Consolidation has the goal of allocating virtual machines on a few physical servers as possible, while satisfying the Service Level Agreement established with users. The effectiveness of a consolidation strategy strongly depends on the forecast of virtual machine resource needs. To this aim, data-driven models can be exploited to develop intelligent

consolidation policies. In particular, migrations are driven by the forecast of the future computational needs (CPU, RAM) of each virtual machine, in order to
efficiently allocate those on the available servers. In this work MuMs VM selection policy is applied as proposed in [2] while VM placement policy is proposed based on linear regression process. Here linear regression is applied for forecasting future resource demands of particular VM to place them on appropriate host which
can satisfy their current as well as future resource demands. These are the basic steps about VM placement
policy:

Step1: Let us suppose there are N VM selected after applying VM selection policy, which are running client task

Step 2: At run time, CPU and RAM needs of each virtual machine are monitored by the VM Monitor module and suitably logged as VM Resource Usage data

Step 3: Periodically, such data are analyzed with the goal to discover usage models for CPU and RAM resources.

Step 4: Such models are used to take VM Migration decision with a period T to forecast resource sizes used by the virtual machines in the next T-time window.

Step 5: Based on this information VM are mapped on available host.

IV. CONCLUSION

In this paper after studying related work linear regression based VM placement policy is decided for improving energy efficiency of the data center as a part of future work this will be implemented in live environment using Amazon EC2.

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