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A SURVEY FOR ENERGY EFFICIENCY IN CLOUD DATA CENTERS

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Abstract

Services such as Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS) are provided by Cloud Computing. Subscription based computing resources and storage is offered in cloud. Cloud Computing is boosted by Virtualization technology. To move running applications or VMs starting with one physical machine then onto the next, while the customer is associated is named as Live VM migration. VM migration is empowered by means of Virtualization innovation to adjust stack in the server farms.
Movement is done fundamentally to deal with the assets progressively. Server Consolidation's main goal is to expel the issue of server sprawl. It tries to pack VMs from daintily stacked host on to fewer machines to satisfy assets needs. On other hand Load balancing helps in distributing workloads across multiple computing resources. Also in the presence of low loaded machines it avoids machines from getting overloaded and maintains efficiency. To balance the load across the systems in various cases, live migration technique is used with the application of various algorithms. The movement of virtual machines from completely stacked physical machines to low stacked physical machines is the instrument to adjust the entire framework stack. When we are worried about the energy consumption in Cloud Computing, VM consolidation & Server Consolidation comes into scenario in Virtual Machine movement method which itself implies that there is low energy consumption.

Keywords: Cloud Computing; Virtual Machine Migration; Energy Consumption; Server Consolidation; Load Balancing.

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1. Introduction

The key technology for cloud computing environment is Virtualization. To build up the different strategies such as VM migration, VM & Server Consolidation for energy efficient computing for businesses and in addition united logical society is spurred by the server farms that comprises of

processing components such as Virtual Machines (VM), Physical Machines (PM) or host hubs that devour immense energy sum amid calculation. The making of different VMs (or virtual servers) on a solitary physical hub offer ascent to Virtual Condition.

Energy efficiency essentially implies that how effectively energy can be utilized or devoured by any virtualized datacenters giving cloud administrations. Energy efficiency expects to lessen the measure of energy devoured to give a set items and administrations without corrupting the QoS prerequisites. The present era of virtualized cloud computing paradigm has grown into a latest exploration area of interest. The requirement for energy efficiency is because of increment in the number and the span of the cloud server farms. To limit the tally of physical machines server consolidation is utilized and the issue of virtual machine placement is to get ideal placement technique with both resource wastage and least power utilization. Various applications on a similar host machine can keep running by Server consolidation, and thus it principally helps in expanding the resource use of the servers and decreasing the energy costs.

Generally, to deal with the convoluted resource request of deployed services and to deal with extra pinnacle requests of the administrations the vast majority of the IT administrations are facilitated on committed physical servers. This raises a issue of server sprawl, in such situations where various, underutilized servers consume up tremendous room and assets than required for their present workloads. Thus, the operational expenses and venture expenses of the service giver is raised. Virtualization based server consolidation is risen to deal with this downside of server sprawl and to accomplish more use of physical resources. Also it reduces energy consumption, hardware costs and operational expenses.

In this paper we demonstrate a survey of the present Energy efficient virtual machine migration strategies particularly to suit the Cloud Computing environments. We give a review of these systems and talk about their methods for productivity.

This paper is further divided into following sections. Section II talk about related work. Section III present Energy Management in Cloud Data Centers. Section IV contains Comparative Analysis, Section V Conclusion and finally section VI as References.

2. Related Work

Various studies have been carried out to explore the research performed in the field of energy efficient VM migration. Extensive research work is going on to build the power efficient datacenter by maintaining energy-performance trade-off in the cloud environment. Different tools are used for conducting experiments on the power aware datacenter. The infrastructure provider today is facing most challenging issues in Energy management in Data Centers. It is unrealistic to keep control over the power utilization as now there is daily increase in the data and processing in the way required as the execution will basically be influenced. Different techniques are there for acquiring this goal which includes application scheduling, DVFS, storage synchronizations adaptive threshold utilization, etc. Along with this various resource allocation techniques are discussed with workload adaptive models and memory reusing techniques [1]. For the maximum use of the resources and energy reduction VM placement issue was examined with focus. Idle server or servers in sleep mode can be switched off to save energy

consumption. HoneyBee algorithm with hierarchical clustering technique is used to solve Virtual machine placement problem with a specific end goal to decrease energy consumption in servers. Simple movement of Virtual Machine relocation and decrease in the network latency is supported by Cluster formation with the HoneyBee algorithm [2]. Virtualization is an essential issue to limit cost brought about to oversee server farms and data centers over the world, in cloud computing. The higher cost in working data centers is because of energy utilization. We can achieve saving by means of constant combination with live relocation of VMs relying on the use of the resources, virtual system topologies and warm condition of figuring hubs [3]. "Virtual redundant machine" is a framework that is made out of a few recreated machines which can empty the heap once the data centers get over-burden, and the idea is to propose this type of system. And hence the major challenges for load balancing mechanism will be fulfilled by the above system for attaining Virtual machine migration [4]. The VM placement issue is displayed into a multi-model optimization issue and given an algorithm to find an optimal list of physical machine based on the model. Virtual machine migration algorithm with versatile load adjusting is engaged by the same [5]. An efficient VM migration plan that is based on of pre-copy approaches is proposed. The proposed migration technique is fast as there is no waiting time for the copy to be transformed and then start the VM by used to attach a host machine which reserves a copy of process data of all VMs and taking decision of source destination for virtual machine migration. Instead of copying the entire memory copy of the VM, the execution log is only transferred, there by further diminishing the volume of information to be migrated. And it is also save energy compare the other migration technique [6]. A VM consolidation approach where both the present and future usage of resources is taken into consideration is proposed which uses a regression-based model to approximate the future CPU and memory utilization of VMs and PMs [7]. A Genetic Algorithm (GA) based VM migration model, namely GAVMM, for heterogeneous MCC system is proposed. In GAVMM, user mobility and load of the cloud servers is taken into consideration to optimize the effectiveness of VM migration. The goal of GAVMM is to select the optimal cloud server for a mobile VM and to limit the aggregate number of VM relocations, bringing about lessened undertaking execution time [8].

3. Energy Management In Cloud Data Centers

The measure of work done in a specific timeframe is generally termed as Energy whereas the rate at which a framework will play out some work while is Power. As it is said that the decrease in power utilization does not generally ensure in the reduction of the energy expended, so the difference of these two quantities should be understood with clarity. The cost of infrastructure provisioning is reduced with the reduction in power consumption. A major issue in clouds is improving the energy efficiency techniques as day by day the cloud users are increasing and the cloud service providers are also taking up with new technologies. The cost of fueling and cooling the data centers is assumed to be 53% of the aggregate operational consumption of data centers. Thus for infrastructure providers it is must to reduce energy consumption for giving better facilities. Hence, the end results are not only to keep up the Administration controls and SLA approaches but also to cut down energy cost. So, there is a great research going on in designing energy efficient data centers and which also have recently received considerable attention. The problem in the designing of the data center has been studied under various perspectives given as:

- Energy-aware job scheduling
- Virtualization of computing resources

- Energy efficient hardware architecture
- Dynamic Voltage and Frequency Scaling (DVFS)
- Server consolidation
- Switching off unused nodes

Application performance and energy efficiency is a key issue in all the above strategies. To maintain the Data centers it is costly as well as it is threatening to the earth in various viewpoints. The enormous measures of power is expended to control and to cool various servers facilitated in these server farms which lead in the high vitality costs and colossal carbon impressions outflow. Cloud specialist organizations need to embrace measures to guarantee that their overall revenue is not decreased excessively because of high energy costs [1].

4. Comparative Analysis

Algorithm	**Approach Used**	**Energy Saved**
Exact VM Allocation	Extended Bin Packing	90% more than Best-Fit formulation and heuristic algorithm
Combination of allocation and migration algorithms	Extended Bin-Packing and Integer Linear Program (ILP)	95% more than Best-Fit formulation and heuristic algorithm
Sorting VMs and PMs to Minimize the use of PMs	Sorting applied to SPMs and SVMs	29% more than Custom Round Robin Allocations
Energy Aware Migration Algorithm	First Fit allocation	22% more than Dynamic Round Robin and Random Choice Method
Sorting VMs and PMs to Minimize the use of PMs and Executing VMs with similar Execution Time on Same PM	Sorting and Executing VMs with similar execution time on same PMs	30% more than Custom Round Robin Allocations
HoneyBee algorithm with hierarchical clustering	Each cluster is considered as a single resource	20% more than Honeybee
Energy-aware resource utilization (ERU) technique	Based on artificial bee colony (ABC) optimization	25% more than First Fit decreasing (FFD) and Ant Colony Optimization (ACO)

5. CONLUSION

This survey has discussed energy efficient techniques in cloud computing environment. To develop sustainable internet-scale IT systems and services, reduction in energy consumption is an important issue considered by any virtualized data center. Energy consumption in data center is carried out in different ways. Migration time, migration cost, SLA violations, processing capacity, saving hosts, number of VM migrations are some other factors considered while designing.

Energy management in Data Centers is one of the most challenging issues faced by the infrastructure providers. Due to the daily increase in the data and processing, it is not possible to keep control over the power consumption in the way required as the performance will primarily be affected.

Some of the existing techniques for energy efficient VM migration were surveyed on. All the techniques mainly focus on reducing the energy consumption to a minimum. There are various ways for achieving this objective via various ways such as Fault Tolerant Migration Techniques, Load Balancing Migration Techniques, and Energy Efficient Migration Techniques. Also there are workload adaptive models, memory reusing techniques and various resource allocation techniques discussed. Overcoming all the barriers for energy efficiency is not possible as each of the techniques throw light on different parameters, though with certain disadvantages of their own.

Techniques can be proposed to reduce the energy consumption and to overcome the energy-performance trade-offs. Various scheduling and consolidation techniques can be applied for reducing the CPU utilization and bring about drastic changes in energy efficiency.

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