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VM Consolidation for Cloud Data Center using Median based Threshold Approach

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Abstract

Cloud computing is an on demand computing model which requires large amount of physical devices and provide services to users on the basis of pay per usage model, therefore excessive demand of cloud computing have also led to the growth of computational power inside datacenters. These datacenters consumes huge amount of energy which results high carbon emission. For the optimization of resources and reduction of energy consumption, virtual machine consolidation can be used by switching the idle nodes to sleep mode or by turning them off and by using live migration of virtual machines. Here, we propose a novel method for consolidation of virtual machines such that it meets Service Level Agreements (SLA) and deals with energy-performance trade-off. Therefore, reduction of SLA violation and minimize the performance degradation during migration are two main objectives in this paper. For the allocation and reallocation of virtual resources depending upon their load, this threshold based approach can be used, in which Median method is used to find lower and upper threshold values. Proposed Median based threshold approach is implemented by using CloudSim and validation of this approach is performed across different workload traces of PlanetLab servers and using some random configuration of Datacenters. Experimental results show that this scheme can provide better SLA performance.

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Keywords: Cloud Computing; Median Method; Threshold Approach; Service Level Agreement; VM Consolidation.

1. Introduction

Cloud computing is a distributed computing with number of virtualized and interconnected computers that provision the computing resources on the basis of SLA (Service Level Agreement) between cloud users and providers. Cloud providers deliver these services and resources depending upon the services offered by cloud architecture with three different layers. SaaS (Software as a service) provides application software as a service. PaaS (Platform as a service) provides platform to deploy the services and application on it and third is IaaS (Infrastructure as a service) which provides basic infrastructure to cloud users. With increasing demand of cloud environment, energy consumption inside data centres is also continuously increasing and results high carbon emission which should be taken care of. Virtualization is the key feature of cloud computing that allows multiple virtual machines inside one physical machine and perform live migration of VMs as well[1]. Different applications with different resource requirements are running simultaneously on same physical machine which led to variable workload on machine. Therefore, consolidation of VM

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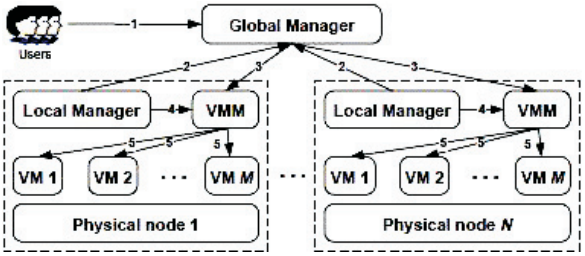

Fig. 1. System Model[13].

on minimum number of active hosts and switching off the ideal host is a novel method to save the energy consumption of environment. But, excessive consolidation may also degrade the performance; therefore to provide high quality of services to users it should be necessary to deal with energy and performance trade-offs[1].

To provide high level of QOS to cloud users, live migration approach is used to consolidate the VMs using four different steps[2]. In which all the virtual machines will be migrated to some another host and switching the ideal node into sleep mode, if the PM is underutilized (with CPU utilization less than some threshold value) and similarly some of the virtual machines will be migrated to different host machine if host machine is overloaded (with CPU utilization greater than some threshold value). Four different steps are: to select which PM is over utilized, to select which PM is underutilized?, select the VM from these underutilized and over utilized host machines, find new placement techniques of VM over the host machine. In this paper, our main focus is on first two parts i.e. to find out the over utilized machine and underutilized machines. For which we proposed a median based threshold approach, whose main objective is to reduce energy consumption as well as SLA violation, performance degradation.

In addition to this paper is organized in following sections. Section 2 presents brief review of related work in VM consolidation. In section 3 we propose median based threshold approach and overview of experimental details. Then, in section 4 we conduct the performance analysis using simulation and analyze the results of our proposed method with previous methods and finally paper is concluded in section 5 along with future scope.

2. Related Work

There is an excessive amount of research on VM consolidation that addresses that it is the best solution for performance and energy management in cloud data centers. According to which workload is consolidated among the lesser number of physical machines. First work in this field, for power management of data centers have proposed by Nathuji and sachwan[3]. An architectural model has been proposed in this paper, in which resource management can be done by global and local managers both. Global manager monitors utilization of host machine for the selection of most appropriate host machine to migration and local manager monitors the power management of guest VM. Process of VM consolidation has been divided into three categories: dynamic VM consolidation, static and semi static[4] by Verma A. and they have used static and semi static approach for live migration and showed that it is more advantageous than dynamic consolidation.

Anton and Rajkumar Buyya[5] presented the VM consolidation into four steps[6]: detection of over utilized and underutilized host machines, selection of VM from these host machines and ten placements of VM over some new host machine. They have also proposed policies such as Random choice policy, minimum migration time, maximum correlation, for the selection of virtual machines from the selected host for migration. Later on, minimization of energy consumption by considering the structural components[7] such as cooling equipments, network topology, rack utilization has been presented by Sina Esfandiarpoor. He also presented structure aware virtual machine placement methods like: NUR, RBR, and HSRC. Abbas Horri also presented their work by considering the consolidation process same as[6]. They have used linear regression (LR) method for over utilized host machines and proposed VM placement algorithm.

Novel heuristics have been introduced for the determination of underutilized host machine by Ehsan Arianyan[1] such as: Migration delay (MDL), Available capacity (AC), TOP-SIS available capacity, number of VMs and migration delay (TACND). They have improved the number of migrations and SLA violation in comparison to previous policies.