VM's Consolidation For Energy Efficiency in Cloud Computing

Mr. Manoj V. Waghmode[1], Mr. Dayal B. Tilekar[2], Mr. Shubham D. Sonawane[3], Mr. Amol K. Sonawane[4]
[1, 2, 3, 4] Imperial College of Engineering and Research, Pune, Maharashtra India

Abstract- *Energy consumption of cloud data centers is a matter of big concern. Dynamic consolidation of Virtual Machines (VMs) play important role to save energy in data centers. This approach gives the live migration of VMs so that some of the under-loaded Physical Machines (PMs) can be switched-off or put into a low-power mode. Therefore, the main concern is to reduce energy usage of data centers with respect to satisfaction of Quality of Service(QoS) requirements. In this paper, we present distributed system architecture to perform dynamic VM consolidation. This is for making energy efficient cloud data centers for maintaining goal of QoS. Due to VM consolidation problem is NP-hard, so that we use significant algorithm called Ant Colony System (ACS). The proposed this algorithm is to finds a near-optimal solution based on a specified objective function. The outcome from existing VM consolidation with ACS algorithm is in terms of energy consumption, number of VM migrations, and QoS requirements concerning performance.*

Keywords- Dynamic VM consolidation, ant colony system, cloud computing, green computing, energy-efficiency, SLA.

I. INTRODUCTION

CLOUD computing is most demanded new computing paradigm. It uses several existing technologies, such as data centers and hardware virtualization. Cloud computing provides three service models. This are Infrastructure as a Service (IaaS), Platform asa Service (PaaS), and Software as a Service (SaaS).Also the four deployment models are private cloud, community cloud, public cloud, and hybrid cloud. With its pay-per-use business model for the customers, cloud computing shifts the capital investment risk for under or over provisioning to the cloud providers. Therefore, several public IaaS, PaaS, and SaaS cloud providers, such as Amazon, Google, and Microsoft, operate large-scale cloud datacenters around the world. Moreover, due to the ever-increasing cloud infrastructure demand, there has been a significant increase in the size and energy consumption of the cloud data centers. High energy-consumption not only translates to a high operating cost, but also leads to higher carbon emissions. .Therefore, energy-related costs and environmental impacts of data centers have become major concerns and research communities are being challenged to find efficient energy-aware resource management strategies.

II. BACKGROUND AND RELATED WORK

The existing VM consolidation approaches, such as are used in data centers to reduce under-utilization of PMs and to optimize their energy-efficiency. The main idea in these approaches is to use live VM migration to periodically consolidate VMs so that some of the under loaded PMs can be released for termination. Determining when it is best to reallocate VMs from an overloaded PM is an important aspect of dynamic VM consolidation that directly influences the resource utilization and QoS. In two static thresholds were used to indicate the time of VM reallocation. This approach keeps the total Central Processing Unit (CPU) utilization of a PM between these thresholds. However, setting static thresholds is not efficient for an environment with dynamic workloads. Therefore, Beloglazov and Buyya presented adaptive thresholds that can be derived based on the statistical analysis of the historical data. Another important aspect of dynamic VM consolidation concerns load prediction on a PM. Using a prediction of the future load enables proactive consolidation of VMs on the overloaded and under-loaded PMs. Therefore, in our previous works, we proposed two regression methods to predict CPU utilization of a PM. These methods use the linear regression and the K-nearest neighbor (KNN) regression algorithms, respectively, to approximate a function based on the data collected during the lifetimes of the VMs. Therefore, we used the function to predict an overloaded or an under-loaded PM for reducing the SLA violations and energy consumption.

DISADVANTAGES:

1. Service Level Agreements
2. A static threshold method (THR) is proposed in that monitors the CPU utilization and migrates a VM when the current utilization exceeds 80% of the total amount of available CPU capacity on the PM.
3. No Live VM Migration

Proposed System

The proposed ACS-based VM Consolidation(ACS-VMC) approach uses artificial ants to consolidate VMs into a reduced number of active PMs according to the current resource requirements.

These ants work in parallel to build VM migration plans based on a specified objective function. The performance of the proposed ACS-VMC approach is evaluated by using Cloud Sim simulations on real workload traces, which were obtained from more than a thousand VMs running on servers located at more than 500 places around the world. The simulation results show that ACS-VMC maintains the desired QoS while reducing energy consumption in a cloud data center. It outperforms existing VM consolidation approaches in terms of energy consumption, number of VM migrations, and number of SLA violations.

The performance of the proposed ACS-VMC approach is evaluated by Cloud Sim simulation onreal workload traces. We compared our proposed approach with the existing dynamic VM consolidation approaches in the CloudSim toolkit and with the ACS-based VM consolidation approach. The results show that ACS-VMC out performs existing VM consolidation approaches in terms of energy consumption, number of VM migrations, and number of SLA violations.

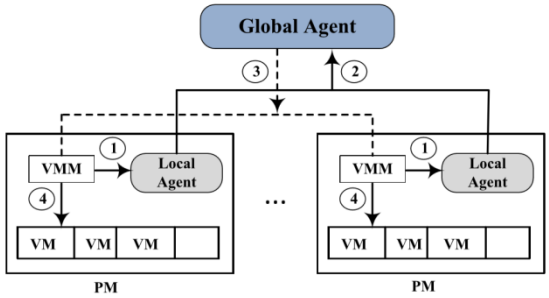
Advantages:

1. Dynamic Virtual Machine(VM).
2. Live VM Migration
3. Ant Colony System
4. ACS-VMC algorithm

The ant colony algorithm is used to find the optimal path that is based on the behavior of ants that are going in search for food. Initially, the ants search the food randomly. When an ant identifies a source of food, it goes back to its colony leaving behind the "markers" (pheromones) that shows the path of the food source. When other ants come across the markers, they are also assumed to follow the path with a certain probability. If they do, then they populate the path with their own markers while bringing the food back to the colony. When more ants find the path, the markers get stronger until there are a couple of lines of ants traveling to different food sources that are near to the colony. This ant colony system algorithm is used for Virtual machine migration

.

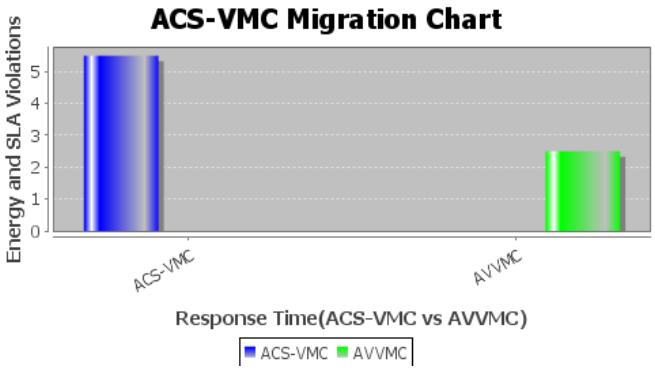
System Architecture



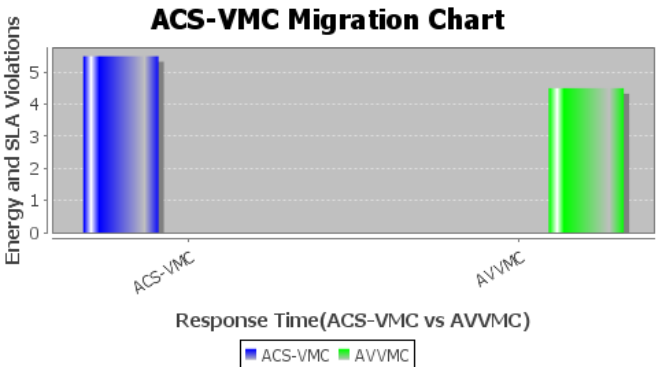
A cloud data center consists of m heterogeneous PMs that have different resource capacities. Each PM contains a CPU, which is often a multi-core. The CPU performance can be defined in terms of Millions of Instructions Per Second (MIPS). In addition, a PM is also characterized by the amount of memory, network I/O, and storage capacity. At any given time, a cloud data center usually serves many simultaneous users. Users submit their requests for provisioning of n VMs, which are allocated to the PMs. The length of each request is specified in millions of instructions (MI). In our proposed approach, the VMs are initially allocated to PMs based on the Best Fit Decreasing (BFD) algorithm, which is one of the best known heuristics for the bin-packing problem [16]. BFD first sorts all VMs by their utilization weights in the decreasing order. Then, it starts with the VMs that require the largest amount of resources.

The BFD algorithm allocates VMs in such a way that the unused capacity in the destination PMs is minimized. Thus, it selects a PM for which the amount of available resources is closest to the requested amount of resources by the VM. Therefore, BFD algorithm provides an initial efficient allocation of VMs. However, due to dynamic workloads, the resource utilizations of VMs continue to vary over time. Therefore, an initial efficient allocation approach needs to be augmented with a VM consolidation algorithm that can be applied periodically. In our proposed approach, the ACSVMC algorithm is applied periodically in order to adapt and optimize the VM placement according to the workload.

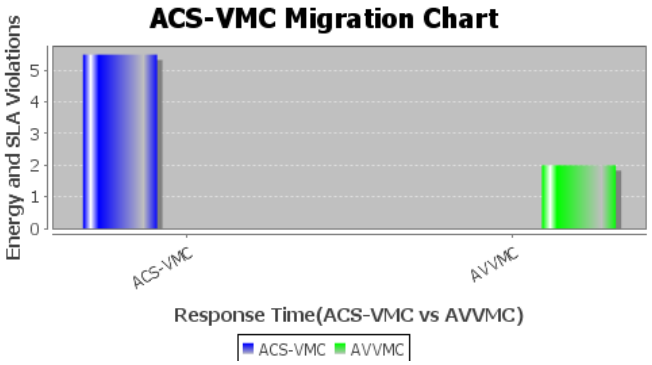
III. PROJECT STATESTICS



First VM Graph



Second VM Graph



Third VM Graph

IV. CONCLUSION

In this paper, we presented a novel dynamic Virtual Machine consolidation approach called ACS-based VM Consolidation. It reduces the energy consumption of data centers by consolidating VMs into a reduced number of active Physical Machines while preserving Quality of Service requirements. Since the VM consolidation problem is strictly NP-hard, we used the Ant Colony System to find a near-optimal solution. We defined a multi-objective function that considers both the number of dormant PMs and the number of migrations. When compared to the existing dynamic VM consolidation approaches, ACS-VMC not only reduced the energy consumption, but also minimized SLA violations and the number of migrations. We evaluated the performance of our proposed approach by conducting experiments with ten different real workload traces.