A Review on Dynamic Consolidation of Virtual Machines for Effective Utilization of Resources and Energy Efficiency in Cloud

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Abstract— In cloud data centers dynamic consolidation of virtual machines (VMs) is the efficient and most effective way to improve the utilization of energy efficiency and resources. The important thing is when it is to reallocate the VMs from an overloaded host is the main aspect of dynamic consolidation of VM that can influence directly on to the resource utilization and quality of service (QoS) of the system. Shortages of resources and performance degradation of applications problems are faced due to server overloading that can influence on the QoS. Host overload detection problem is generally heuristic based and can be solved using statistical analysis of historical data. But these approaches leads to suboptimal results and influenced on QoS goal. This novel approach can solve the problem of host overload detection using the different algorithms and techniques. This paper gives a review on a dynamic consolidation of virtual machines for effective utilization of resources and energy efficiency in the cloud environment.

Key words: Distributed systems, cloud computing, virtualization, dynamic consolidation, energy efficiency, host overload detection

I. INTRODUCTION

Cloud computing is an evaluation of the virtualization technology and having lots of resources that are very useful and accessible and such resources can be used on ademand basis with nominal or no charges. In this paper, we can analyze the first sub problem-the problem of host overload detection. Detecting how and when the host becomes overloaded and influence directly on to the QoS. Cloud computing uses the virtualization in which resources are divided into several execution environment. The IaaS (Infrastructure as a Service) model of cloud computing has been rapidly grown and adapted by many enterprises to improve their total cost of ownership and also provides optimal utilization of resources and money. A small software program like virtual machine monitor (VMM) manages and control the VM related operations. In server consolidation, the reduction in the number of servers can improve the system availability, reducing the infrastructure complexity and also saving the energy and cost that is beneficial for data centers.

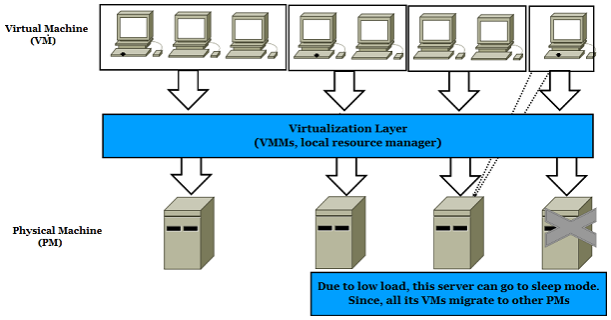

Fig. 1: VM Consolidation

VM consolidation can achieve its goal by increasing the number of the server but in an IaaS environment, there arise some problems that might influence the energy efficiency of cloud. The first issue is the trade-off between the energy consumption, resource utilization and performance of VMs. The server performance degradation can increase the energy saving. Another problem is the server overload that is caused during consolidation is a continuous live migration of VMs due to the continuous changing resource demand. Also, the cloud data center resources are needed to be allocated equally for the satisfaction of QoS. So the virtual machines scheduling techniques are used for the data center consolidation i.e. reducing the number of physical machines, dynamic server consolidation can improve the energy efficiency by optimum utilization of available resources.

II. LITERATURE SURVEY

J. Koomey[2]Dynamic power management (DPM) is anflexible and general design methodology for the controlling performance, evaluation and power levels system of digital circuits, by exploiting the redundancy and efficiency of their components. This technique is provided with a power manager that monitors and analyse the overall system and component states and controls the state transitions. This control procedure is called power management policy.

The main approaches to host overload detection for energy efficient dynamic consolidation of VM stated in the literature can be broadly divided into three categories: aPeriodic adaptation of the threshold-based heuristics, VM placement (no overload detection), and decision-making based on statistical analysis and study of historical data. One of the first works, in which dynamic VM consolidation has been applied to minimize energy consumption in a servers has been performed by Nathuji and Schwan [5]. They explored and explained the energy benefits obtained by consolidating VMs using migration and found that the overall energy consumption can be significantly reduced.

Verma et al. [7] defined a bin packing problem with variable bin sizes and costs for the power-aware dynamic placement of application. Live migration of virtual machines was used to move VMs to a new host in he server at each time slice. In their study, SLAV was not considered in the model. In their latest work [22], VM consolidation technique is divided into static, semi-static, and dynamic categories in the system. In the static consolidation, VMs reside on theserver for a long duration. In semi-static consolidation, live migration is utilized in daily or weekly basis form and in a dynamic, the algorithms hours, minutes, or seconds. The focus of their papers was only in the first and second categories. In thisstudy, however, considered dynamic consolidation as Dynamic Consolidation of Virtual

Machines for effective Utilization of Resources and Energy Efficiency in Cloud environment.

Zhu et al. [8] studied the dynamic consolidation problem of VM and applied a heuristic of setting a static utilization of CPU threshold is set, to determine when a host is overloaded. The host is assumed to be overloaded when the threshold is goes beyond the capacity. The utilization threshold has been first introduced and examined by the author, Gmach [10] based on their analysis of workload on the virtual machines. In their recent work,Gmach [11] investigated the study benefits of combining both periodic and reactive threshold capacity based invocations of the migration controller.

D. Gmach, J. Rolia, L. Cherkasova [11] States that the technique to minimize migrations over consecutive control interval. In the field, some researchers proposed to limit the capacity requirement of resources and an application workload to a percentile of its resource demand. The impact of sustained performance degradation over time on user experience this does not take into account as our required capacity definition does.

VMware Distributed Power Management [12] is based on the same idea with the utilization threshold. However, static threshold is not suitable for systems with unknown and dynamic workloads, as these combinationsdo not takes to workload changes and do not capture the averaged and efficient time behavior of the system. We have enhanced the static threshold heuristic in his previous work [19] by dynamically adapting the value of the threshold according to statistical analysis of the resource workload history. In this paper, we use static and dynamic threshold capacity heuristics as benchmark algorithms for the technique in the experimental evaluation of the proposed model.

Guenter [16] and colleagues explained a dynamic aggregation system model of energy aware virtual machine based on the web applications. In this analysis, the response time of the model defines via SLA. They applied a linear regression in order to foresee the future workload analysis and optimize the allocation of resources which has been carried out before. This regression model which has called local regression model and had been study and presented in the previous works, will actively implement the resources placement on such algorithm. It will be used as a benchmark algorithm in this article. Dynamic Consolidation of Virtual Machines for efficient and Effective Utilization of Resources and Energy Efficiency in Cloud environment.

Bobroff et al [17] states to perform study and trace analysis on commercial web servers and outline a method to identify the servers that are good candidates for dynamic placement of VM. However, none of these studies provide a characterization of the inter-relationship between various workloads in the server, as required for static consolidation of VMs.

Beloglazov and R. Buyya [19] had evaluated hosts determination policies on the VMs as well as selecting the virtual machines in the starting point. The statistical indicators has been used in the considered policies in order to choose the overloaded host on the server. Eventually, it has been shown that the effect of LR-MMT policy on a number of migrations of VM, energy consumption, and SLA fault is higher than the other policies in the environment. For a dynamic virtual machine consolidation, different heuristics policies have been proposed for finding overloaded and over-utilized hosts and VMs selection. The authors suggested and introduce four methods for detecting overloaded hosts on the virtual machine i.e. Inter-quartile Range, Local Regression (LR),Median Absolute Deviation, and Robust Local Regression and three methods for VM selection i.e. Random Choice, Minimum Migration Time, and Maximum Correlation. The experimental result revealedthat compared to other combinations of method, the combination of Minimum Migration Time (MMT) for VM selection and Local Regression (LR) for overloaded host detection, which was decent LR/MMT in our experimental result has the best result concerning energy consumption, SLA violation, and (the) number of live migrations.

Jung and colleagues [12] in their study have assessed and examine the power distribution management in the virtual machines with respect to the fixed and high threshold in order to determine overloaded hosts in the server. The results for this study show that fixed high threshold level is not suitable for the systems which have a dynamic or unknown workload. The result shows a lack of proper efficiency of presented solution in the dynamic systems.

Wang and colleagues [22] had evaluated the control policies for the allocation of resources management based on the response time constraints of the QoS metrics in server and cluster level capacity. If the resource capacity of a server and cluster is not sufficient for satisfying Service level agreement (SLA), then virtual machines can be migrated from the server. All these operational works are similar to the discovery methods based on athresholdcapacity which is depends on the moment values of the performance characteristics

Xiaoqing Zhang [23] describes that the users of the system haveheterogeneous and dynamic demands in cloud computing environment. Through the study, Static virtual machine placement doesn't suit for this dynamic situation. The author proposed dynamic consolidation for virtual machine placement model, which defines the virtual machine placement as a constraint and resource satisfaction problem. For solving such problem, the algorithm that is based on improved bin packing is presented, which one not only obtains least used physical hosts on the system, but also can minimizesthe virtual machine migrationcost during the dynamic consolidation. Simulation results of this analysis shows that this strategy not only get less active physical hosts system, which can lead to save much energy, but also greatly reduces virtual machine migration data.

Esmail Asyabi[24] states that the cloud computing paradigms have introduced a new model of computing to reduce the cost that associated with hardware and software resources management by shifting the location of computing infrastructure model to the Internet network The Cloud Computing model uses virtualization technology to effectively and efficiently consolidate virtual machines (VMs) into physical machines (PMs) to improve the utilization of PMs onto the server. Studies however has shown that the average utilization of physical machine in many of the Cloud data centers is still lower than we expected. The Cloud computing model is expected to improve the existing current level of utilization by

employing new approaches and techniques of consolidation mechanisms. In this paper author propose a new approach for dynamic consolidation of VMs in order to improve the utilization of physical machines. This is done by using the dynamic programing algorithm that selects the optimal solution and best VMs for migration from an overloaded physical machine, also considering the migration overhead of a VM. Finally evaluation results demonstrate that used algorithms achieve good performance.

III. Conclusion

In this review paper, we have studied a Markov chain model and control algorithm for the host overload detection problem of as a part of dynamic consolidation of VM. These several models allow a system administrator to explicitly set a QoS goal parameter in terms of the OTF parameter that are workload independent QoS parameter metric. This survey focuses on such consolidation techniques that mainly detailing with the placement algorithms of VM and methods used to reach an optimal solution for this such a respective problem. The objective of these techniques is used either be the providing QoS parameter or minimization of power consumption for the virtual machines, both being in conflict to system. So in this study we examine that for the implementation of the MHOD algorithm of the VM manager within the OpenStack Cloud environment to evaluate the algorithm in a real system as a part of energy-efficient dynamic VM consolidation.

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