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ABSTRACT

In current era, the trend of cloud computing is increasing with every passing day due to one of its dominant service i.e. Infrastructure as a service (IAAS), which virtualizes the hardware by creating multiple instances of VMs on single physical machine. Virtualizing the hardware leads to the improvement of resource utilization but it also makes the system over utilized with inefficient performance. Therefore, these VMs need to be migrated to another physical machine using VM consolidation process in order to reduce the amount of host machines and to improve the performance of system. Thus, the idea of placing the virtual machines on some other hosts leads to the proposal of many new algorithms of VM placement. However, the reduced set of physical machines needs the lesser amount of power consumption therefore; in current work the authors have presented a decision making VM placement system based on genetic algorithm and compared it with three predefined VM placement techniques based on classical bin packing. This analysis contributes to better understand the effects of the placement strategies over the overall performance of cloud environment and how the use of genetic algorithm delivers the better results for VM placement than classical bin packing algorithms.

KEYWORDS
Bin Packing, Cloud Environment, Energy Minimization, Virtual Machines, Virtualization, VM Migration, VM Placement

1. INTRODUCTION

Emerging trend of applications requires the demand of cloud environment and this term of cloud computing is defined by (Buyya, 2009) which is a parallel and distributed system with large number of virtualized computers where the provisioning of their resources is provided according to the mentioned SLA (Service Level Agreement) that has been signed between cloud service user and service provider. Virtualization is important features of cloud computing environment and it provides elasticity to the environment. Virtualization helps to reduce the cost of infrastructure and improve machine utilization. It is also an efficient technology for resource sharing in cloud environment. Different types of open source software framework are used for the implementation of virtualization, and hypervisor is one of them defined by (Nurmi et al., 2009). Hypervisor is a virtual machine manager that gives permission for multiple operating systems to run parallelly on one host machine and therefore, by allocating more virtual machines on a single host can minimize the cost of infrastructure as well as...
consumption of energy inside data center. Thus, the objective of current research is the minimizing the consumption of energy of datacenter by considering the performance of cloud environment and thus, the VM placement is an effective technique for this purpose.

These data centers consume more power than official buildings, city and house hold appliances. Cooling systems, network and computation processing are the main part of power consumption inside data centers. Data center consume 1.1% to 1.5% of overall electricity consumed in the world wide and which is growing 12% per year (Sharma et al., 2015). To manage and utilize the resources of data center in energy efficient way is a big challenge. Here, our study focuses the sub part of VM consolidation process i.e. VM placement process for the energy efficient management of resources. VM consolidation process helps to make decision of efficient VM placement by mapping virtual machines to appropriate servers defined by (Ferdaus et al., 2014). The process of VM consolidation can also minimize the consumption of energy of the data center by migrating virtual machines to some another host, replacement of VMs to reduce the load of host machine or by switching idle physical machines to low power states (Sharma et al., 2016). This energy consumption should be minimized without violating the SLA that specifies the quality of services (QOS) provided by cloud service providers. VM consolidation process uses different heuristics to select which virtual machine should be placed on which host machine. Dynamic placement of VMs on physical hosts depends upon the physical resources available on the host and resource requirement of the virtual machines.

Here, the main contributions of this paper are as follows:

- First we have discussed the VM placement technique, a sub part of VM consolidation process.
- We have compared various predefined VM placement techniques based on classical bin packing and analyzed that how these VM placement strategies affects the overall performance of cloud environment.
- We have proposed a decision making system for VM placement technique using one of the Evolutionary algorithms i.e. basic Genetic algorithms.

The layout of current manuscript is framed as, the section 2 presents the relevant work on VM placement along with various techniques used for virtual machines placement. Section 3 briefly describes about the previous predefined heuristic VM placement techniques along with the proposed model of VM placement Section 4 describes the framework or simulation environment and performance metrics that we have used for the implementation of VM consolidation process. Section 5 shows comparative analysis of various VM placement techniques and finally the manuscript is concluded in section 6 along with some future research directions.

2. RELATED WORK

Current scenario for the research works has focused on the reduction of energy or power consumption of data centers and several techniques have been used for their reduction inside the data centers. Current cloud computing paradigms uses virtualization of hardware to attain this objective using VM consolidation, VM placement, server consolidation, VM migration and many more. In paper (Lin et al., 2011) author used the concept of VM consolidation for energy or power minimization using dynamic round robin algorithm for scheduling VMs according to which physical machine will force to migrate its VM if it is active from long time with shutting down that particular host. In (Wei, B et al., 2011) author proposed the placement of virtual machine on the basis of fitness parameter which can be calculated by available physical resources and demanded resources of virtual machines.

VM consolidation is a multi-objective optimization and NP hard problem which can be solved by both heuristic and metaheuristic techniques such that: Bin packing, linear programming, constraint programming and using Evolutionary algorithms. The classical solution for VM consolidation
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