A Study on Virtual Machine Migration Algorithms in Cloud Computing

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ABSTRACT

Cloud Computing is an emerging field which has invited people from academia and industry for research. The three service models namely Infrastructure as a Service(IaaS),Platform as a Service(IaaS) and Software as a Service(SaaS) have dramatically impacted the software industry from all domains. All traditional legacy systems have now become cloud based systems. Redefining the storage and computing,placing it out of the premises some where in the cloud is the main idea of cloud computing . While storing/computing the virtual machines(VM) in the cloud need to be migrated for various reasons like Load Balancing,maximum throughput, minimize downtime,maximize efficiency etc. Virtual Machine migration is inevitable in all cases so there are various algorithms in the market which has been categorized into genetic ,nature based and chemistry based. Here in this paper exploring the available algorithms gives an insight to the intricacies and nuances of understanding about the algorithm. Various criteria come to focus and also getting to know that some criteria depend on the purpose and Quality of Service(QoS) they have to abide by. Studying about VM migration algorithms gives a detailed understanding of it and clarifies the fact, based on the need it is necessary for a new one in the market.

Keywords: Cloud Computing VM Migration, Load Balancing, Genetic Approach, Heuristic Approach.

Introduction

A cloud refers to a distinct Information Technology (IT) environment that is designed for the purpose of remotely provisioning scalable and measured IT resources[15]. Cloud computing is the delivery of computing services – servers,storage,databases, networking,software, analytics, intelligence etc. over the internet to offer faster innovation,flexible resources and economies of scale in a pay per use basis.

Nearly every business is using some form of cloud computing or storage service. Cloud computing has transformed so many businesses throughout the past decade with its scalability, versatility, and reliability[16].

In cloud business the provider and the consumerarebonded by the Service Level Agreement(SLA) an agreement between them on the list of services called Quality of Services(QoS). As the consumer pay on the basis of his usage the quality standards are followed to the core. Any violation in QoS will cost the provider so the factors listed in it plays a key role in the business lifetime.

Cloud providers invest a lot of time and energy in devising an algorithm for their own requirements so there are numerous algorithms in the market. The rest of the paper elaborates a survey on VM migration algorithms.

Related Work

Egalitarian[1] minimizes the total rank sum of the outcome by finding the stable matching fair to both the VNs and servers as an application of deferred acceptance procedure. But this is applicable to moderate and large number of matchings , at times it is not applicable due to its computational burden and very less performance improvement.

Need for resource provisioning and allocation algorithm[2] for optimal CPU allocation satisfying stringent SLA for mission critical applications are the few open challenges among many of them. This clearly depicts the evident need for new algorithms for consumer specific services in IaaS.

In [3] the authors bring out the open challenges in resource management by splitting the dimensions of it like resource provision,resource allocation,resource mapping and resource adaptation. Overall, they bring out the need of algorithm in each and the necessity of an optimal and customized approach. They suggest introducinghuman reasoning to be embedded in agents to provide a better performance.

Srichandsan.S et all [4] does a pareto analysis for task scheduling to include the SLA and QoS. The new algorithm reduces the makespan with minimum energy consumption. The only concern here is the time gets elapsed more when a crossover is desired which makes it complex also to include many components for resource allocation and task scheduling.

The authors of [5] have proposed an efficient VM migration algorithm which involves minimum number of migrations of VM. It works on Backtracking principle and amounts to minimum energy utilization so as to help in reducing the green house gases, Hence they claim the algorithms as Energy efficient. Though it saves energy by reducing the number of migrations when comparing with existing algorithms it fails SLA by a considerable percentage and downtime is also increased.

In [6],they have come up with cloud vehicular networks using a hierarchical architecture. The resources shared between vehicles are computational,storage and bandwidth.Resource reservation scheme is used for VM migration.Using this scheme, they found a significant reduction of the service dropping rate during VM migration. Reserving a resource exclusively for migrated VMs reduce the service dropping rate during migration may be suitable for the fast moving, short time needed vehicular networks but not in the case of VM migration which will be for VMs occupying more time in a Virtual Cluster(VC). VC is a group of VMs.

Multi objective Ant Colony Optimization[7] is inspired from Ant Colony Optimization with an improvisationto includemore than one objective for placing VMs in Physical Machine(PM). A PM is an actual machine. It is claimed energy efficient by minimizing the total resource wastage and power consumption. This algorithm takes a little longer time when number of VMs are increase to 2000s, yet they claim this algorithm is suitable for large data centers

Proposal of a new algorithm[8] which is of genetic in nature computes in advance the influence of VM migration and based upon the result the decision of migration is taken. This is one another candidate of nature inspired algorithm which can not be scaled up, the limitation faced by the previous one.

After studying Load Balancing techniques[9] the authors come to the conclusion that even after including very many factors for devising an algorithm for load balancing there is a due need to consider the energy efficiency hence reducing the emissions of green house gases making it towards Green Computing.

Honey Bee behavior inspired load balancing[10] of tasks in cloud computing environment is a new approach to handle VM migration from heavy load. Here tasks re viewed as honey bees and VMs are compared to food sources. They claim that this algorithm brings out increased throughput but also handles task priority. Honey Bee foraging strategy works for only one criterion of QoS. When multiple criteria of QoS comes in this algorithm is not a proper choice.

The authors[11] in their survey brings out two brad categories of algorithms such as Heuristic and Meta heuristic. It is found that there can be any number of heuristic algorithms created for specific needs of system in cloud computing. There are various factors which play role in the overall performance of cloud systems. As a result, heuristic approach can take any one or combination of factors to develop an algorithm to suit the need of target applications running in cloud systems. The next step of simulation can also be done by various options like CloudSim, CloudSched and FlexCloud. There are reasonable number of researches which have used the above-mentioned simulation tools and has shown the justification criteria. As an alternate there is also realistic platform to test such as OpenNebula, ElasticHost and EC2.

In Load Balancing[12] a new algorithm is devised to balance the load of a cloud data center.A new entity called Central Load Balancer is introduced which makes sure that the VM is not overutilized and underutilized at any point of time. This algorithm has performed better than its counterparts by decreasing the response time in simulation results by having number of VMs and data size per requests increasing in each test run.

A new scheduling strategy[13] introduces a look ahead part of scheduling in VM by taking into account the history and the current state of the system , analyze the influence of this on the outcome and thereby taking the one which has the least influence on the system. The approach is of genetic type. As a result, the load imbalance is reduced and dynamic migration isavoided.

In contrary to the above [14] dynamic resource allocation in VM resource allocation is claiming to support green computing. A concept of skewness to measure the unevenness is introduced to improve the overall utilization of server by minimizing it. Heuristic technique prevents overload and there by saves the energy used

Conclusion

After surveying the above work, two different approaches namely Genetic and Heuristic comes to the picture. Our aim is to devise a new algorithm can be of any one category or a hybrid one. Having done a thorough study reveals the fact that there is always a need for a new algorithm for VM migration and the algorithm depends on the target application in cloud systems. The factors to be included in the algorithm can be one or more simple or complex depends on the ultimate usage of the algorithm itself.

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