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Design and QosAnalysis of Novel Collaborative Layered Approach ForCloud Resource Management

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Abstract

Present-era is relying on high technology mobile, broadband and wireless technologies. These technologies accomplish their tasks with the help of cloud computing services. Cloud computing technology provides the storage, infrastructure and software "as service", allow users to access services with flexible and economical way through internet. In this paper cloud resource management and QoS (quality of service) has discussed. We used cloud simulator cloudSim to simulate our collaborative layered approach for resource allocation and management. This collaborative layered approach consists of Virtual machine allocation(VMAllocation) policy, virtual machine scheduler (VMScheduler) and virtual machine migration (VMMigration) controller. Enhanced VMAllocation policy provides hosts based on load balancing and aging constraints. VMScheduler provides best time shared scheduling to allocate resources to virtual machine to particular host. Virtual machine controller uses fuzzy logic to control the migration of virtual machines. We analyses the service providing time and success rate of our collaborative layered approach in different scenarios to ensure the QOS.This approach provide better resource management for cloud service providers(CSP) as it reduces the response time and enhanced service availability.

Keywords: CloudSim,VMAllocation policy,cloud service providers, VMSchedulerandVMMigration.

Introduction

Cloud computing is now considered as de facto standard forweb services.Hosting, storage andmanagement all of them have done with cloud technology only. It consist differentresearch dimensions such as virtualization and Service Oriented Architecture (SOA)[1],[24][20]. Cloud computing technology can providesresources that is

scalable, dynamic andvirtual in all the scenarioscloud service providers uses the concept ofinfrastructure as a services to particular clients through the Internet in an economical and flexible manner, also provideelastic scaling of cloud resources[2]. These services are provided on user usage or demand basis so cost is reduced much. The importance of Cloud services continuously increase, resource management plays a crucial role within the cloud infrastructure layer[35][36][40]. TheCloud infrastructure basically starts with establishment of data center (DC)[5],[6],[36]. After the establishment of DC, next task is how well resources are allocated and managed in data center.dynamic usage of user based on location and various geographical establishment of DC,quality of Internet , speed , bandwidth and Cloud service acquirementall of these importantfactors in resource management in cloud .Many years distributed systemenvironment is evolved from sharing architecture platforms to task specific models. The latest advancementof these models is cloud computing.[2][12]

The cloud services are classified into three major types of service first is "Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS)"[13],[27],[22]. In This paper we are focusing on IaaS. Infrastructure as a Service provides virtual environment of unlimited resources which is available to users. It can be used on demand basis. However, it offers best suitable and flexibility service for particular application. It provides different packages, resources and service to different applications. It also ensures easy development of provider service in cloud platform with full dedicated authority to developer [25]. The management of these service and their resources is big task so cloud resource management is very important aspect for CSP [13],[38]. Cloud resource management consist of resource allocation and load balancing [9][14][29]. In this paper collaborative layered approach for resource management has discussed. Basically it is divided in two layers. first layer ensures that host has be chosen which has less aging and high load .this approach provides better load balancing in cloud environment. Second layer ensure time shared scheduling with VMMigration controller which uses fuzzy controller [3]. Large scaled cloud services such as social networking applications can be benefited and we analyses the response time and success ratio to ensure that it will meet Service Level Agreements (SLAs) and perform the highQoS to users[15],[23],[32].

Related Work:

Cloud resource management suffers from performance degradation and form virtual machine migration.so a controller is required to control the virtual machine migration. "QoS Guarantees and Service Differentiation for Dynamic Cloud Applications" [1] this paper concluded that fuzzy calculation based approach for resource management in cloud to optimize the performance. The fuzzy controller is two layered approach [3]the first layer provides objective approach for QoS by tacking the difference between referenced value and original value and minimizingerror in each iteration.The second layer implements scheduling part of program.

Self-tuning fuzzy controllers (STFC) maintains these error values as weight. The gained weights are dynamically adjusted by according to error rate. ifmultiple

serviceand demanded resource is beyond the available resource capacity then multi-level objectives can be assigned.

$$\mathbf{E(x)}=\begin{cases}\frac{b(x)-a(x)}{b(x)}\,\mathbf{0} < a(x) < 2b(x)\\ \quad -1a(x) > 2b(x)\end{cases}$$

*x*is control interval. *e*(*k*) and Δ*e*(*k*) are calculated using the reference value *b*(*x*) and the observed value *a*(*x*).this framework is consuming 5% of extra cpu resources and takes much response time .

"Agent-based Layered Cloud Resource Management Model"[3]in this paper layeredapproach to optimize the resource management has presented .It is a hierarchical model which is based on agent .agent is intelligent system which behaves according to the circumstances in cloud environment. This agent layer resides between application layer and resource allocation layer. Drawback of this model is ,it is hypothetical model.

"Workload-Based Software Rejuvenation in Cloud Systems" [4]in this paper they have Presented that taking account of aging of virtual machines plays a crucial role of load balancing [15],[16],[17].This approach is based on calculating the aging of virtual machine monitor in cloud environment .it uses timer based approach to calculate aging.

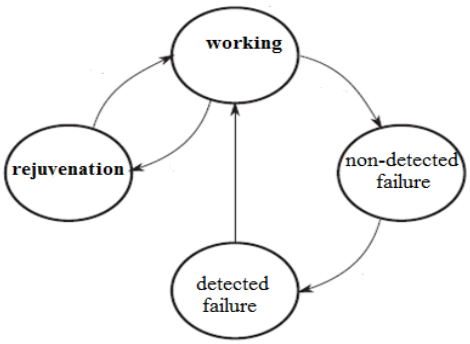

Figure1: Different State of VMM

In this paper timer can vary in different scenarios.

"Analysis, Modeling and Simulation of Workload Patterns in a Large-Scale Utility CloudSim this paperpresents the Diversity Patterns in Cloud can play an important role in resource management and QOS in cloud environment[8][28,][29],[31]. Various time zone and location have different load at different time[11],[10] . user may requires different type of resourcesin different time. Earth is divided in six time zone and they have calculated each time zone have approximate no of CPU,memory and ram uses[32],[33]. So this data can be used for further research in the area of load balancing [21][18][19] .

There are many cloud resource management approaches are present but for optimal resource management we are proposing a layered collaborative approach which can assure QoS with minimum response time.

System Design and Methodology

Architecture

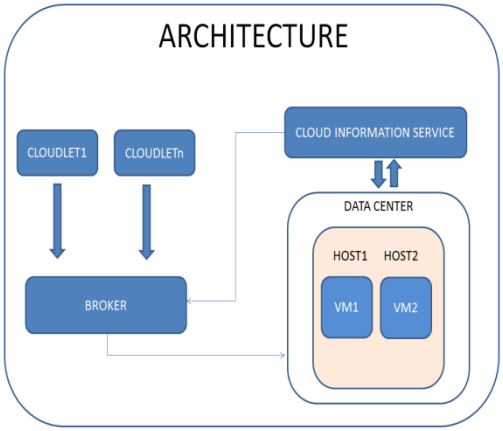

Figure 2: Architecture of Cloud management and QOS

Cloudlet:
These are tasks which can be assigns to host and host further assigns to VMs.

Broker:
It contains information about data centers and characteristics of data centers, likeBandwidth, processing units and ram.

Cloud Information Service:
It is registry for data centers and it provide information to broker. Data center contains host which are physical unit of execution and host contains VMs for execution of cloudlets[34].

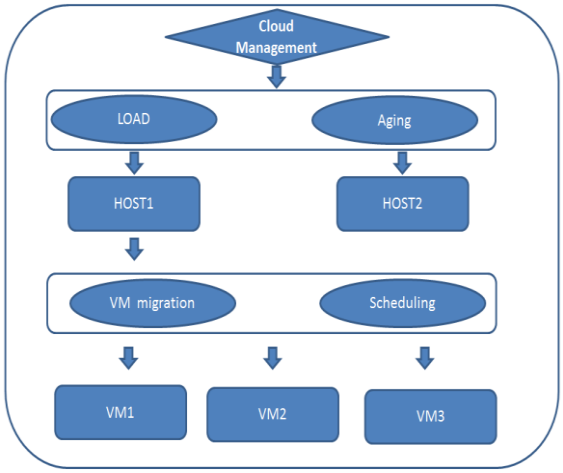

Figure 3: Flow Model of Cloud Management AndQOS

VM Migration Control:
The VM migration can be controlled using specified controller logic.
if (R>Y){
R=(R-Y)/R;
}
performance degradation due to migration = VARIENT Y% MIPS
The destination host only experience R% of the migrating VM's MIPS

Scheduling:
Time Sharing with dynamic virtual machine performance evaluation scheduling algorithm can be used for resource scheduling to VMs.

Diversity Pattern:
The Cloud computing model has Highly dynamic environments where customers from different contexts co-exist submitting workloads with diverse resource requirements at any time [7].This problem can be handled using selecting a datacenter and host which has highest load (h).

Aging:
Once instantiated, a VM starts its execution providing the user an execution environment but maintains information of VM. As soon as the service is completed, the VM instance is stopped, and age is calculated.

VM Allocation Policy:

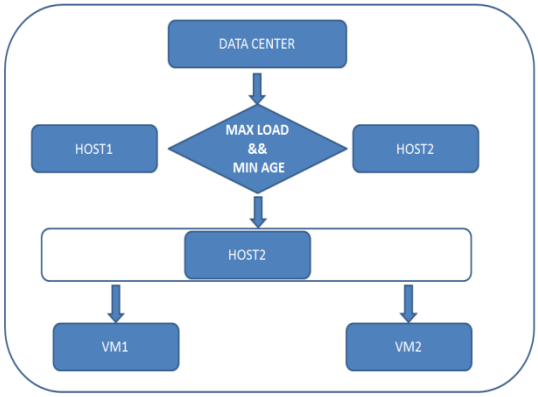

Figure 4: Load variance and aging of Cloud management

Data Center:
It contains hosts. Host mat vary from one data center to another. Data center register itself with cloud information service with data center characteristics.

Host:
It is physical unit for execution of cloudlets. It contains virtual machines.

Virtual Machine:
it is virtual unit for execution of cloudlets.

VM Scheduler:
A host which has less no processing units as per requirement of cloudlet has been chosen in this strategy. Geographical area that has high load has been chosen and ahost which has less age according to the calculation needed to bechosen in this strategy.

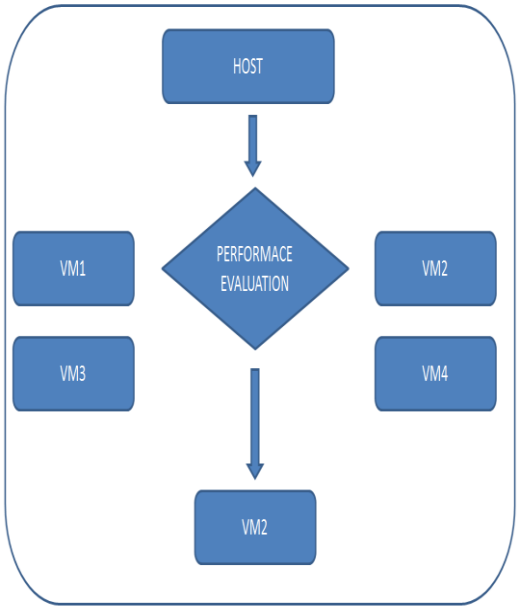

Figure 5: Virtual machine migration control for Cloud management

When one host is not able to fulfill the requirement of virtual machine and work load is high then it has migrate from one host to another to accomplish the task. This phenomenon is called VM migration.
VM migration causes performance degradation of cloud service[30]. For better usability of cloud service with VM migration is a controller unit which minimize the degradation. The VM migration can be controlled using specified controller logic.these two parameter has considered first is performance degradation due to migration and second is destination host only experience some percentage of the migrating VM's.

Implementation

We have implemented novel virtual machine allocation policy which controls load balancing as well as take account of aging also. we also has consideredvirtual machine migration may cause performance degradation in cloud so we proposed aVMScheduler policy which controls the VM migration.
CloudSim 3.03 is a simulator which is used for complete simulation of cloud environment and our proposed layered collaborative approach(LCA).we have tested this approach under various scenarios for QoS analysis. These two policy improves the resource management and QoS of cloud services.

VM Allocation Policy:
This policy has been used for simulation with additional functionalities as mention below. A host which has less number of processing units as per requirement of cloudlet has chosen in this strategy. A host which geographical area that has high load

has chosen in this strategy. A host which has less age according to calculation need to be chooses in this strategy.

VM Scheduling Policy:
Scheduling is key aspect of resource management.Scheduling of virtual machines faces problem of virtual machine migration. So we are proposing a virtual machine migration controller which maintains the VMMigration using fuzzy logic.

Result and Analysis

We have implemented layered collaborative approach for cloud resource management. We have compared our results with virtual agent based approach in different scenarios.

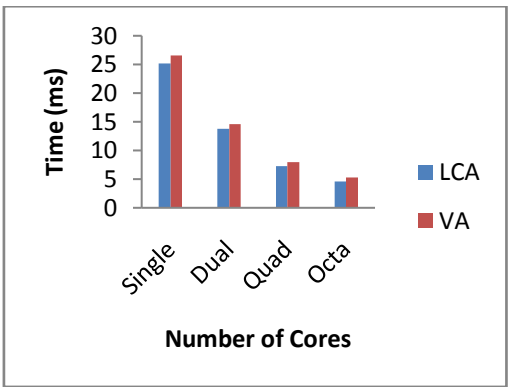

Figure 6: Performance Evaluation of Number Cores Vs Time (Ms)

In the figure 6 when number of core or no of processing unit increase the time complexity is reduced up to Quad core significantly but after that it improves linearly.

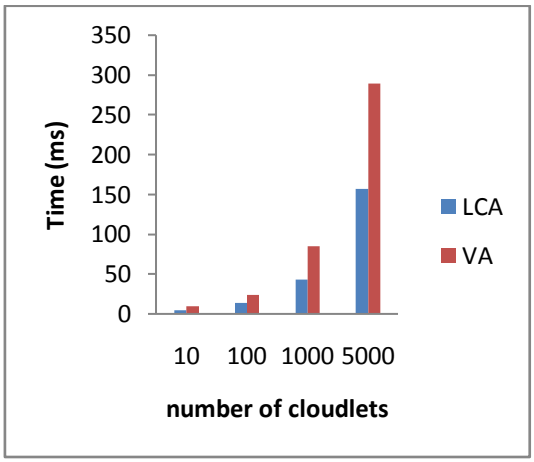

Figure 7: performance evaluation of no of cloudlets vs time

In the figure 7 no of cloudlets or task has been performed in quad core machine our layered collaborative approach takes less time as compared to virtual agent based approach because it balances load well distributes task for parallel execution.

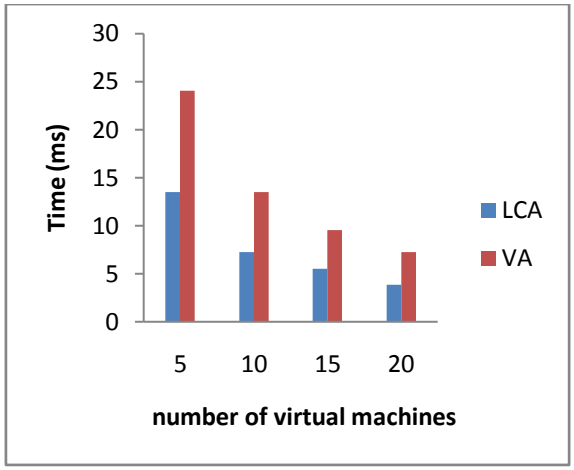

Figure 8: performance evaluation of number VM vs time (ms)

Figure 8 shows the number the virtual machines plays critical role in processing time of cloudlets because it provides enough resources to compute cloudlets.

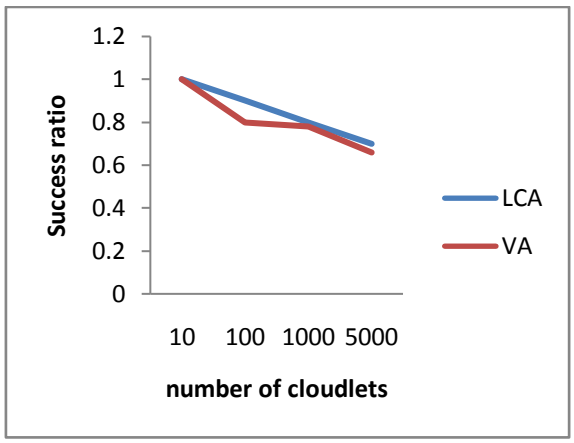

Figure 9:performance evaluation of number cloudlets vs success ratio

In figure 9 as number of cloudlets increase success ratiodeficits because of high resource requirement but our approach shows constant and better decreasing rate.

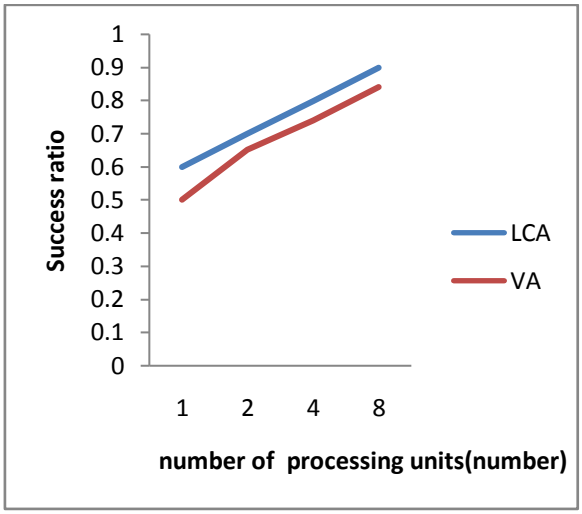

Figure 10: Performance Evaluation of Number Processing Units Vs Success Ratio

Figure 10 shows our approach gives higher success ratio as number of processing units increases because it balance the load and take account of aging so it reflects on optimum success ratio.

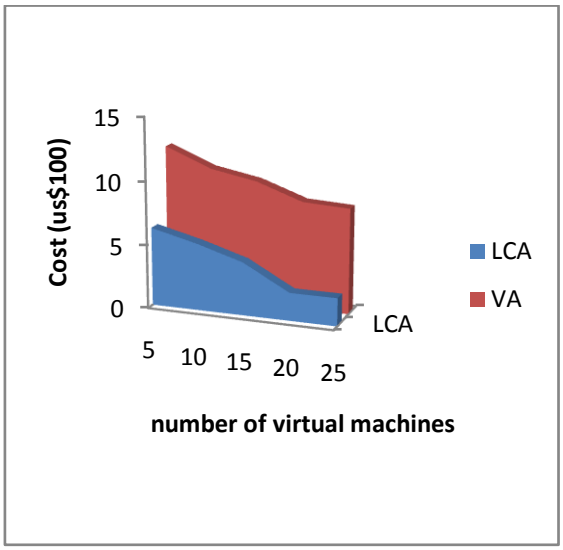

Figure 11: Performance Evaluation of Number Virtual Machines VsCost

In figure 11cost is evaluated according to standard amazon cloud service cost values. Our approach show significantcost effective when number of virtual machines are increase butafter optimum value it remains constant.

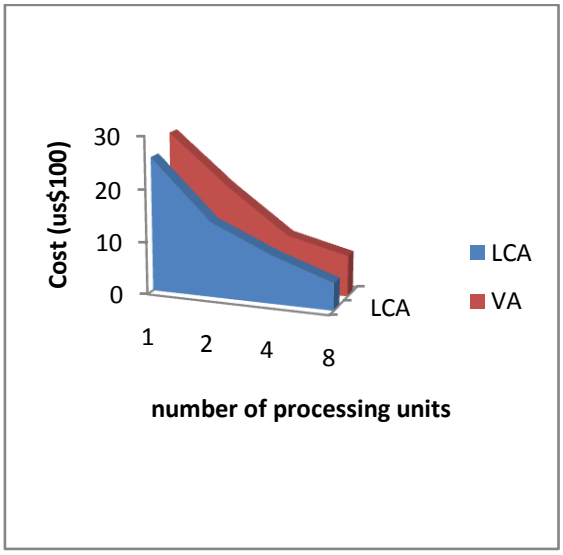

Figure 12: Performance Evaluation of Number Processing Units Vs Cost

Figure 12 shows when number of processing units increase the cost is reduced n after reaching optimum point it remains constant.
So we have seen our layered collaborative approach for cloud resource management shows higher success ratio and provides better performance in multicore architecture.

Conclusion

In this project Layered collaborative approach has been explained.Load managementprovides service for load balancing in the geographical domain.Aging assure the service will be available to all consumers.Virtual machine migration caused performance degradationreduces by fuzzy controller.We have presented success ratio of resource allocation and evaluate performance of approach in multicore machines.this evaluationshows our approach gives optimum performance in multicore architecture. We also evaluated average cost of cloudlet in different scenarios which shows our approach is economically well suited for large scale cloud services.

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