Performance Analysis of Cloud Computing Environment and Comparision with IaaS model using CloudAnalyst

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***Abstract*— Cloud computing is an advance technology which provides its resources, application and system software as a service to the end user following the pay as you go model. It can provide fly based quality of service using its infrastructure as a service. It is very difficult to the researcher and industry user to identify the performance of Internet based application using real cloud platform. So we use the tool to identify the performance of application so that we can easily deploy it on real cloud with minimum cost. We know that in cloud based application cost is associated with two parameter virtual machine and data transfer corresponding to the user base. Simulation tool is based on cloudsim preexisting tool kit which is the preference of every researcher to test the performance of cloud configuration. Data center is the main resource of the cloud which holds the computing and storage server with number of host machine. To run the applications on cloud we follow hear the task model i.e. we run the cloudlet gridlet(cloud task which include the user request user program etc.). For tool based simulation we inherit the implementation policy (Time shared and Space Shared) and provisioning technique at each level of resources in cloud environment. Over the cloud resource we use no of host with processing power measured in (MIPS) to run the application. i.e. faster the processing means greater the MIPS value of host at data center. Tool based simulation enables seamless modeling, simulation and experimentation of emerging cloud computing infrastructures and management service, Hence tool based simulation of cloud computing environment may help the users to access and deploy applications from anywhere in the world on demand at competitive cost depending on the users quality of service requirement.**

Keywords-Cloudsim, MIPS, gridlet, Virtual machine, Data center, Simulation, SaaS, PaaS, IaaS;

I. INTRODUCTION

Cloud computing is the internet based computing in which all computational operation is made to be performed over the cloud. We know that for resource management more cost need to be pay. So it is better to use the resources on rent basis rather than to buy our own resources. Each organization wants to make busy their employee for innovation and high quality resource utilization. Cloud Computing is basically increasing the utilization of IT. Simplest definition of cloud computing is "To provide IT as a service" is called cloud computing. This is the part of distributed computation. The main component of IT is hardware, software (application, system) etc. are provided as a service by the cloud Computing. While using cloud computing cloud vendors can provides the secure pool of resources which include the storage and computing server or blade server. It provides the massive distributed environment which may dynamic in nature. To control this type of distributed system we need to study some simulation tool. Simulation tool which are used for distributed application based on object oriented programming. Simjava, Grdilet, Cloudsim, CloudAnalyst are the cloud simulation tool which provide the clue to us how to deploy application and what are the IT requirements for the application. These tools follow the layered architecture i.e. user can add their own layer over the user code level. Simulation tool provides the prior information about cloud resources which required for application deployment. We can use our own policy at data center level to share the MIPS of the physical processing element. Using simulation tool we can setup the different cloud configuration with internet characteristics. Processing power of the CPU to run their application is provisioned in time and space shared mode. We take an example of social networking application to deploy at different region with different internet characteristics, data center configuration.

II. RELATED WORK

Distributed system consist a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources. Their service-level agreements established through negotiation between the service provider and consumers" [1].The level on which computing services are offered to the consumer varies according to the abstraction level of the service. In the lowest level, Infrastructure as a Service (IaaS), services are supplied in the form of hardware where consumers deploy virtual machines, software platforms to support their applications. An example of an IaaS service is Amazon EC2 [7].In the next level, Cloud consumers do not have to handle virtual machines. Instead, a software platform for hosting applications (typically, web applications) is already installed in an infrastructure and offered to consumers. Then, consumers use the platform to develop their specific application. This strategy is known as Platform as a Service (PaaS) Examples of this case are Google App Engine [8] and Aneka. Finally, in Software as a Service (SaaS), an application is offered to consumers, which do not have to handle virtual machines and software platforms that host the application. Repeatable and controlled experiments on any of these levels require the use of other experimentation methodologies than real execution in a real platform. Simulation is one of such alternative and this is the focus of this work. There are many simulation techniques to investigate behavior of large scale distributed systems, as well as tools to support the research work. Some of these simulators are GridSim [2], Micro Grid [3], GangSim [12], SimGrid [4] and CloudSim [5]. While the first three focus on Grid computing systems, CloudSim is, for the best of our knowledge, the only simulation framework for studying Cloud computing systems. Nevertheless, grid simulators have been used to evaluate costs of executing distributed applications deployed in Cloud infrastructures [8][9]. GridSim toolkit was developed to address the problem of performance evaluation of real large scaled distributed environments (typically Grid systems but it also supports simulation of P2P networks) in a repeatable and controlled manner. GridSim toolkit is a Java-based simulation toolkit that supports modeling and simulation of heterogeneous Grid resources, users spread across multiple organizations with their own policies for scheduling applications. It supports multiple application models and Provides primitives for creation of application tasks, mapping of tasks to resources, and managing of tasks and resources. CloudSim enables seamless modeling, simulation, and experimenting on Cloud computing infrastructures. It is a self-contained platform that can be used to model datacenters, service brokers, and scheduling and allocation policies of large scale Cloud platforms. It provides a virtualization engine with extensive features for modeling life-cycle management of virtual machines in a data center, including policies for provisioning of virtual machines to hosts, scheduling of resources of hosts among virtual machines, scheduling of tasks in virtual machines, and modeling of costs incurring in such operations. CloudSim framework is built on top of GridSim toolkit. CloudSim allows simulation of scenarios modeling IaaS, PaaS, and SaaS, because it offers basic components such as Hosts, Virtual Machines, and applications that model the three types of services. Cloud Analyst is built directly on top of CloudSim toolkit, leveraging the features of the original framework and extending some of the capabilities of CloudSim. Cloud Analyst design and features are presented in the next section.

III. CLOUD ANALYST

Even though Clouds make deployment of large scale applications easier and cheaper, it also creates new issues for developers. Because Cloud infrastructures are distributed, applications can be deployed in different geographic locations, and the chosen distribution of the application impacts its performance for users that are far from the data center. Internet applications are accessed by users around the world, This Simulation tool provides the repeatable and controlled environment to setup the data center configuration, Cloud configuration and Internet characteristics for the cloud tasks Simulation experiments apply models of both applications and infrastructures. So, simulation requires some effort. Using cloud analyst toolkit we evaluate the performance of cloud based applications like social networking application. Application statistics we get the simulation results which help in quality of service improvement. Response time and data center processing time act as a performance evaluation parameter.

IV. A CASE STUDY

A. Simulation of a Large Scale Social Networking Application

A typical large scale application on the Internet that can benefit from Cloud technology is social networking applications. These applications may benefit from Clouds because they typically present non-uniform usage patterns. Access to such services varies along the time of the day, and geographic location of sources of service requests also varies. Cloud allows infrastructures to dynamically react to increase in requests, by dynamically increasing application resources, and reducing available resources when the number of requests reduces. So, SLAs between Cloud providers and consumers are met with a minimal cost for consumers. One well-known social networking site is Facebook [7]. This has over 200 million registered users over worldwide. On 18/06/2009 the approximate distribution of the Facebook user base across the globe was the following: North America: 80 million of users; South America: 20 million of users; Europe: 60 million of users; Asia: 27 million of users; Africa: 5 million of users; and Oceania: 8 million of users. This case study, model the behavior of social networking applications such as Facebook and use Cloud Analyst to evaluate costs and performance.

V. SIMULATION RESULTS

Simulation results obtained by using CloudAnalyst are shown below in the tabular form. Simulation results can help for performance analysis of Cloud based application. It includes the simulation scenario, simulation results for the Cloud model with variable parameters across different scenario.

Scenario	Scenario description
1	1 data center with 50 VMs
2	2 data centers with 25 VMs each
3	2 data centers with 50 VMs each with peak load sharing
4	2 data centers with 50 VMs each with throttling
5	3 data centers with 50 VMs each with peak load sharing
6	3 data centers with 75,50,25 VMs, with peak load sharing and throttling

Table I Simulation Scenario

Scenario	Overall average response time (ms)	Overall average time spent for processing a request by a data center (ms)
1	1057.75	759.61
2	939.07	751.74
3	943.40	756.21
4	564.22	382.87
5	901.38	745.68
6	902.61	746.74

Table II Simulation Results with variable SaaS, PaaS, IaaS parameters

Scenario	Overall average response time (ms)	Overall average time spent for processing a request by a data center (ms)
1	619.99	320.74
2	937.70	750.09
3	942.74	755.28
4	564.71	383.53
5	900.75	744.30
6	902.20	746.54

Table III Simulation Results with varying IaaS parameters

Above Table I, Table II and Table III summarize the simulation settings and experimental results. It shows that bringing the service closer to the users improves the quality of service (response time in this case). It is an expected effect, because users experiments have less effect from internet issues when they are geographically closer to the application server or computing server. From above results it is quite clear that high quality of service is achieved when we follow the throttling as a load balancing policy across virtual machine in each cloud resource (data center). This policy acts analogous to the accelerator of a car which speed up the car while pressing it.

A. Simulation results can be described by using **mat lab tool** for comparison of results regarding to the different cloud configuration. It is quite clear from above result that when we increase the no of cloud resources near to the user base then response time is improved i.e. we should deploy our application using more cloud resource at different geographical location using minimum performance evaluation parameter.

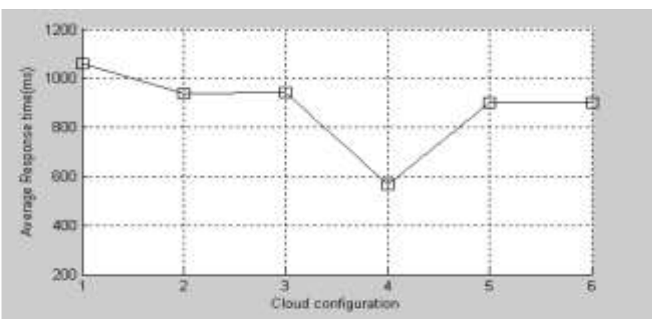
B. Overall average response time and Overall average time spent for processing request by a datacenter is minimum in case of cloud configuration 4 with 2 data center and 50 virtual machine each because we use throttling for load balancing policies across virtual machines at data center.

C. Bringing the service closer to the users improves the quality of service (response time in this case).

D. Service quality can be further improved by the applying of load balancing at the application level across data centers (by different service brokerage policies) and also at virtual machine level within data centers. But the levels of improvement achieved depend largely on the load balancing algorithms employed. For such improvements to be effective, sufficient capacity is required in the data centers to meet the peak demand of requests from different user base at different geographical regions.

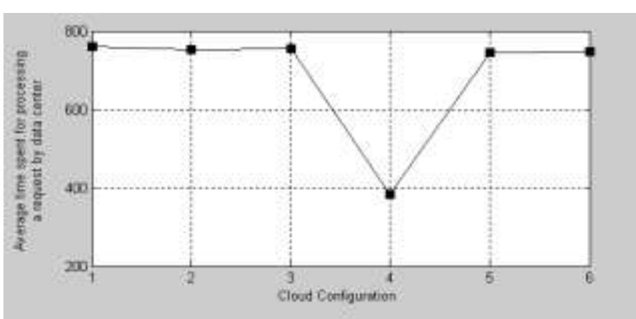
VI. EXPERIMENTAL RESULTS FOR VARIABLE PARAMETER ACROSS ALL CLOUD MODEL

Following figures depicts variation of response time with respect to the cloud configurations. Minimum response time is achieved at cloud configuration 4 i.e. corresponding to the throttling as a load balancing policy across virtual machine in each cloud resource (data center). This policy acts analogous to the accelerator of a car which speed up the car while pressing it. From this result it is quite clear that for high quality of service we should deploy our application at the data center where this policy is followed across the virtual machine. We use the index table of virtual machine. When data center controller put the request to run the cloudlet on virtual machine then unique id of the virtual machine is return to allocate the cloudlet run. In this analysis tool we use time shared policy for core provisioning to the virtual machine. Data center broker take the responsibility to deal with entire life cycle of Virtual machine. Index table is also maintained for the status of virtual machine that may be busy or available. At the start all VM's are available. Hence from graphical results describe below it is clear that we get high quality of service when virtual machine load balancing policy is throttled and cloud application service broker policy is optimize response time and virtual machine deployed at the data center are in bundled from. We get minimum response time,



processing time in cloud configuration 4 having 2 data center with 50 virtual machine as shown in figure (a) and figure (b).

Figure: (a) Response time versus cloud configuration



(b) Overall average time spent for processing a request by a data center (milliseconds) versus cloud configuration

VII. EXPERIMENTAL RESULTS FOR VARING PARAMETER ACROSS IaaS MODEL

Following figure c and figure d shows the variation of response time and processing time with respect to different cloud configuration with variable IaaS parameters we get the high quality of service in more than one cloud configuration. i.e. in cloud configuration 1 and 4 i.e minimum response time in 4 is due to the throttling process while in 1 is due to the more power full infrastructure at the cloud resource level . i.e. Qos can be improved while focusing only on the parameters of lowest cloud computing model i.e. IaaS. From figure d it is clear that processing time is minimum in cloud configuration 1 i.e. in this case entire MIPS power of the PE is used by the single data center in a time shared mode. i.e. overall average time spent for processing a request by a data center (milliseconds) minimum in case of variable core IaaS parameter.

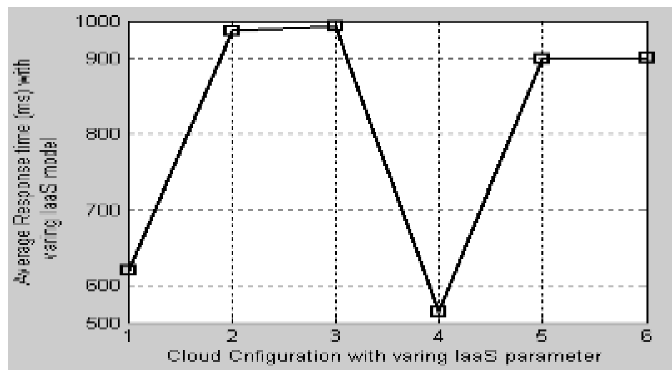
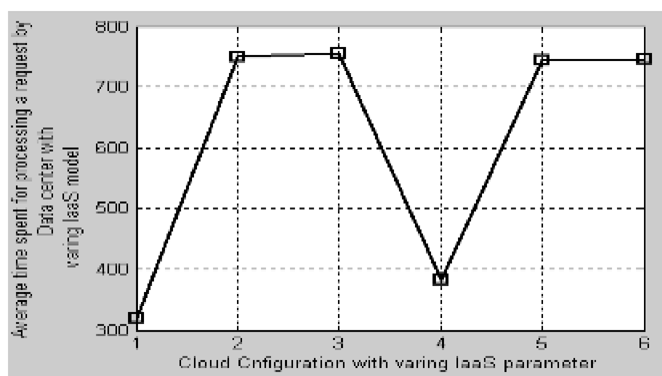


Figure: (c) Response time versus cloud configuration with varying IaaS parameter



(d) Overall average time spent for processing a request by a data center (milliseconds) versus cloud configuration with varying IaaS parameter

VIII. COMPARISION OF TWO EXPERIMENTAL RESULTS BASED ON VARIATION OF CLOUD MODEL PARAMETERS ACROSS SaaS, PaaS, IaaS

A. while comparing two experimental results it is quite clear that while deploying an application over the real cloud Quality of service can be achieved while focusing on single cloud computing model i.e. IaaS model.

B. It can give the assurance of minimum overall average time spent for processing a request by a data center (milliseconds) in cloud configuration with minimum no core cloud resources which include set of storage and computing servers

C. From figure c it is clear that cloud configuration 1 can provide better quality of service (Qos parameter is response time) when we use stronger hardware configuration at IaaS level of simulated cloud.

D. Qos improvement regarding to the response time is 41% and regarding to the processing time is 57% approximately i.e. while deploying the application on real cloud we follow the cloud configuration 1 and 4 as per requirement of cloud user.

E. While focusing on parameters of IaaS model we use Round Robin algorithm across virtual machine in a single data center, service broker policy is optimize response time. While variation of parameters across IaaS, PaaS, SaaS we use throttled algorithm for load balancing across virtual machine.

IX. CONCLUSION

With the advancement of Cloud technologies rapidly, there is a new need for tools to study and analyze the benefits of the technology and how to apply the technology to the large-scale applications. A typical type of Internet application that could benefit from the flexibility of Cloud type services is social networking. Tool based analysis of cloud computing environment is the first step to deploy our application on real cloud computing environment e.g. Amazon EC2, In this paper we use statistical data for the social networking applications, and setup the simulation scenarios and identify the best cloud configuration for real deployment of application. We demonstrated how CloudAnalyst can be used to model and evaluate a real world problem through a case study of a social networking application deployed on the cloud. We have illustrated how the simulator can be used to effectively identify overall usage patterns and how such usage patterns affect data centers hosting the application. Furthermore, we showed how those observations provide insights in how to optimize the deployment architecture of the application. Using our on resource provisioning policy at virtual machine level we can improve the quality of service and using simulation results we can fine tune the performance while deploying the application over the real cloud.

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