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Performance evaluation of cloud application with constant data center configuration and variable service broker policy using CloudSim

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Abstract: Internet based computation is the demand of present IT infrastructure. All computational operations are handled by the resource provider which include storage, computing and network resources. Internet based computing I.e. cloud computing is the best alternative for handling the IT resources and use I T as a service. To identify the performance of cloud resources simulation results plays its roll. i.e. Best way to understand the functionality of Cloud Computing is cloud simulation tool. Cloud simulation tool provide the test bed to understand the association of cloud entity and event. Tool provides the sustainable, fault tolerant environment for experimental evaluation of cloud based application like social sites and scientific work flow. Using simulation tool we can find out the finish time taken by the SaaS modeler to run over the virtual machine using resource provisioning algorithm i.e. time shared and space shared at each level. We follow the basic layered architecture of utility Computing. We use the different service broker policy at Application deployment configuration level to improve the performance. Simulation results provide the clue to identify the best service broker policy to setup the main cloud configuration.

Keywords: Cloudsim, MIPS, Gridlet, Virtual machine, Data center, Simulation, SaaS, PaaS, IaaS, VM.

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, Gridlet, 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.

Related Work

Distributed system consist a collection of inter connected 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 CloudAnalyst. Cloud Analyst design and features are presented in the next section.

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.

Simulation Configuration parameters

TABLE I: User base characteristic

Name	Region	Request per user/hr.	Data-size per request (byte)	Peak Hour start (GMT)	Peak Hour end (GMT)	Avg. peak user	Average of peak user
UB1	0	60	1000	3	9	1000	100
UB2	1						
UB3	2						
UB4	3						
UB5	4						
UB6	5						

Above Table describe the details about the group of computers act as user base. User send the request to the data center node from different geographic region. User base may be deploying in any region corresponding to the continent. Each user base follows the attributes to identify the no of request, no of user who put the request for cloud application.

Request may come from any region and it is handled by the computing server. Quality of service depends on service broker policy and load balancing policy across virtual machine.

TABLE II: Application deployment configuration

Data Center	No. of Virtual Machine	Image Size	Memory	Bandwidth	Service Broker policy
DC1	5	10000	512	1000	Closest data center
					Optimize response time
					Resource allocation dynamically

Table II include the information about the deployment of cloud application. For Constant data center configuration we deploy the application with variation of service broker policy and virtualization specification.

TABLE III: Data center configuration

Region	Arch	OS	VMM	Physical hardware Units
DC1	X86	LINUX	Xen	2

It include the information about the cloud main resource i.e. data center. We need to specify the virtual appliance; system software and architecture followed by the storage a computing node.

TABLE IV: Physical hardware details of DC1

ID	Memory (Mb)	Storage (Mb)	Available bandwidth	No. of processor	Processor Speed	Vm Policy
0	204800	100000000	1000000	4	10000	Time Shared

Table describes the details of each physical hardware node deployed at data center of cloud. Server farm of cloud may include no of hardware node with different configuration. In this work we setup the data center with constant configuration. Physical hardware deployed at data center includes the information about the storage, computing power of node and resource reservation policy.

TABLE V: Advanced configuration

User Grouping factor	Request Grouping factor	Instruction length per request (byte)	Load Balancing policy across virtual machine in a single data center
100	10	100	Round Robin

Table describes the Advance configuration parameters. Simultaneous user supported by the each server at data center and number of user requests from each user base in different geographic region and load balancing across the virtual machine after deployment process of cloud base application e.g. social networking application like Facebook.

A Case Study

A. Simulation of Cloud base 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.

Simulation Results

User Base With min Response Time	Min Response Time(ms)	Service Broker Policy
UB1	50.23	Closest Data Center
UB1	49.99	Optimize Response Time
UB1	52.02	Resource Allocation Dynamically

Table describes the simulation results using simulation configuration parameters given in section IV. Corresponding to the same user base with different service broker policy we get the different response time. Minimum response time is found in case of optimize response time policy i.e. it should be the first priority of the deployment of cloud base application. i.e. Quality of service can be improved while focusing on parameters of main cloud configuration. It depends on Internet characteristics of geographic region from where the user base sends the request.

Service Broker Policy	Overall response time (ms)	Data Center processing time (ms)
Closest Data Center	292.38	0.32
Optimize Response Time	292.85	0.28
Reallocate Dynamically	293.73	1.73

Table describes the overall response time when the cloud users send the request from user base located in different geographic region. Cloud main resource data center give the response and handle the request of cloud user. Two service broker policy i.e. closest data center, optimize response time give the optimal, closer results for response time and data center processing time with high quality of service. From above results it is quite clear that for constant data center configuration we should follow the service broker policy i.e. optimize response time.

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 constant data center configuration, and setup the simulation scenarios and identify the best service broker policy at main 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 own 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. For real deployment of application user need to specify the main cloud configuration parameter e.g. service broker policy. I n this paper got the simulation results and identify the best service broker policy i.e. optimize response time and closet data center. i.e. request should be handle by the data center which is closer to the user base.

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