A Survey on Various Cloud Simulators

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Abstract

Cloud computing is the trendy topic in today's world. As there are so much service providers of the cloud are available in thecompetitive world. , a decision has to be taken that which service provider's services are more advantageous to the organization..As the adoption and deployment of cloud computing increase, it is critical to evaluate the performance of cloud environments.The use of simulation tools leads to decrease in overall conceptual or operational cost of the organizations. There are different simulation tools available in the market. This paper enlists some of the simulation tools used for the purpose of simulation and modeling.

Keywords — *Cloud Computing, Simulation Tools, Comparison between simulation tools, Services of Cloud Computing, Components of Cloud Computing.*

I. INTRODUCTION

Cloud Computing is a model for enabling convenient and on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal service provider interaction[1]. Cloud Computing can be viewed from two different perspectives: Cloud application and Cloud infrastructure as the building block for the application. Most organizations today focus on adopting Cloud Computing model so that they can cut capital expenditure, efforts and control operating costs. These reasons trigger the aggressive growth for cloud adoption in business[2]. Some of the traditional cloud based application services include social networking, webhosting, content delivery and real time instrumented data processing, which has different composition, configuration and deployment requirements. Quantifying the performance of scheduling and allocation policies in a real Cloud computing environment for different application models is extremely challenging. The organization that wants to access these resources just have to pay some little amount to the service providers. This amount is very lesser as compared to purchasing of each resource. People, today, are shifting from traditional computing towards cloud as it provides higher reliability, fault tolerance, broad network access, on demand usage etc [1].

Cloud computing or Fog computing refers to the facility of processing and storing data in the Local Area Networks in conjunction with the cloud computing.

II. COMPONENTS OF CLOUD COMPUTING

The cloud computing encompasses virtual pool of resources and applications that can be used through a self service portal. The components of the cloud computing according to the end user are explained as follows:

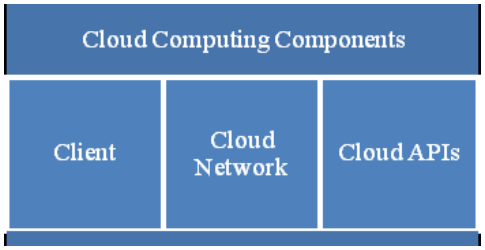

Fig. 1: Components of Cloud Computing

A. Client

A client is a device or software that user can use as an interface to access the services related to clouds.

B. Cloud Network

It is a network connection between the client and the cloud service providers. The network connection for accessing the services of cloud is so much important. Each and every services of cloud are accessed with a constant network connection.

C. Cloud Application Programming Interface (APIs)

The cloud API includes the set of instructions that abstract the implementation of the cloud service from the users. API helps the programmer to connecting the various cloud services.

III. SERVICE MODELS OF CLOUD COMPUTING

Cloud computing offers three high level cloud service models. These services are selected according to the requirement of the organization. These services are described as follows:

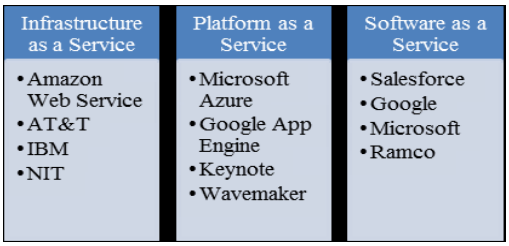

Fig.2 Services & Service Providers of Cloud Computing

A. Infrastructure-as-a-Service (IaaS):

IaaS service provides the hardware services to the user. The services includes in this case is processing power, storage, network
bandwidth or other hardware required to setup the computing environment in an organization. When users get access to these
resources, he or she can install their operating systems on the provided hardware. The responsibility to maintain hardware security
lies on the user.

B. Platform-as-a-Service (PaaS):

PaaS service provides hardware services with operating systems. User just has to install the required applications on those hardware resources. The responsibility to manage the licensing of the software depends on the user of those resources.

C. Software-as-a-Service (SaaS):

In this model the cloud service providers provides the software services to the user. User only needs to run an internet connectionto have access to the software. The responsibility of maintaining the licensing of the software depends on the cloud serviceproviders. The customer uses the provider's applications running on cloud infrastructure [3].

IV. SIMULATION TOOLS

Some cloud suffers from significant issues like high monetary cost involved in the cloud resources and also cost of internet for using these resources that may cause many disturbances in the budget of organization. So there is a solution to test the clouds before adopting any cloud services. This solution is Cloud Simulation Tools. The simulation tools contemplate a better option in spite of being real cloud as dispatch experiment is difficult and costly to execute. Effective resource utilization is not possible in the case of cloud

V. ADVANTAGES OF CLOUD SIMULATION TOOLS

Cloud simulation tools offer several advantages over the cloud service. Such as:

A. No Capital Investment Involved

Simulation tools does not requires any installation and nor even maintenance cost

B. Provides Better Results

Simulation tools helps user to change input very easily as when needed, which provide better results as an output

C. Risk are Evaluated at Earlier Stage

Simulation tools involve no capital cost while running as in case of being on cloud. This helps in identifying of risks with design
or any parameter at earlier stage.

VI. CLOUD SIMULATION TOOLS

A. CloudSim

Popular simulator developed in CLOUDS Laboratory at university of Melbourne. This simulation tool used in large data centers. The CloudSim toolkit supports both system and behavior modeling of cloud system components such as data centers, Virtual Machines and resource provision policies [2].

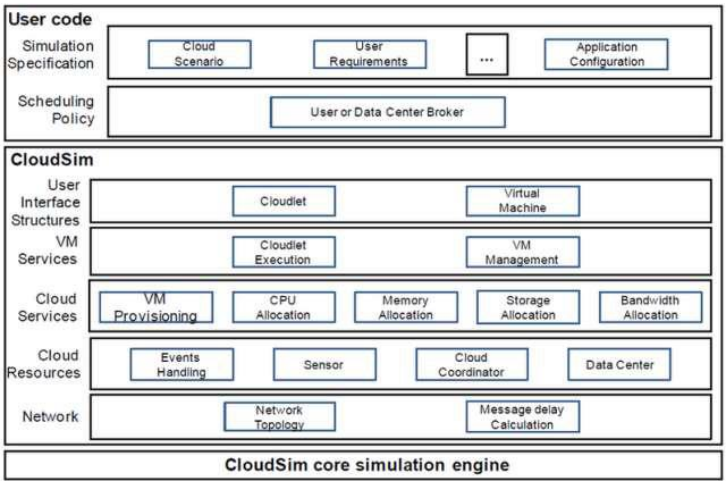

Fig. 3Architecture of CloudSim

The CloudSim simulator is a layered architecture. The different layers of cloudsim are shown in the above figure.

1) Network Layer:

This layer of CloudSim has responsibility to make communication possible between different layers. This layer also identifies how resources in cloud environment are placed and managed.

2) Cloud Resources:

This layer includes different main resources like datacenters, cloud coordinator (ensures that different resources of the cloud can work in a collaborative way in a cloud environment.

3) Cloud Services:

This layer includes different service provided to the user of cloud services. The various services of cloudsinclude Information as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

4) User Interface:

This layer provides the interaction between user and the simulator.

B. GDCSim:

GDC is a Green Data Center Simulator. It combines both modular and large scale entities. Green Datacenter is constructed to run as economically as possible.

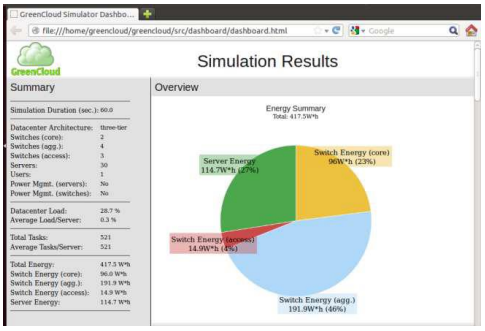

Fig. 2: Green Cloud Simulator View

C. Cloud Analyst

Cloud Analyst is the most popular visualized type of simulators. This tool can be used easily and produces output in graphical format. It creates difference between programming environment and simulation environment.

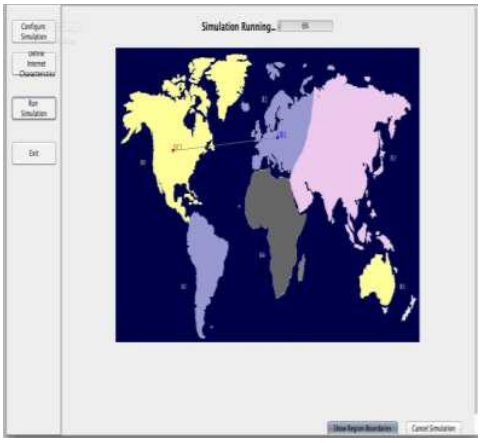

Fig. 3 Cloud Analyst Simulator

D. Network Cloud

It provides an extension to CloudSim by implementing network layer. It increases the performance of CloudSim. In this simulationtool, each entity is to be mapped with a single BRITE node so that network cloud sim can work properly [1].

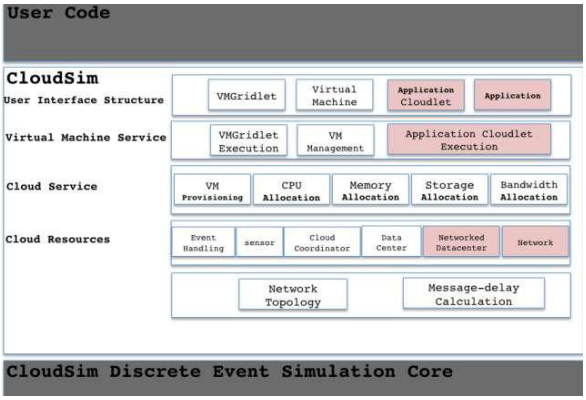

Fig. 4 Network CloudSim

E. MDCSim

It is used to analyze and predict the hardware related issues of the servers and data centers.

F. SPECI Sim

SPECI is Simulation Program for Elastic Cloud Infrastructure. It is used to analyze the scalability and performance concepts relatedto data centers.

G. Ground Sim

It is an event driven simulator used for grid and cloud servers. It is mostly used for IaaS. It can also be extended for PaaS or SaaS services of cloud.

H. DC Sim

DC is Data Center Simulator, offering IaaS service of cloud and used to develop datacenter techniques.

I. UEC

Ubuntu Enterprise Cloud (UEC) is an open stack public cloud. It works with the integration of number of different other open software.

J. iCan Cloud

This cloud does not require any modifications when there is requirement to test cloud in different architectures.

K. Teach Cloud

TeachCloud is a cloud simulator which is specially made for education purposes. TeachCloud provides a simple graphical interface through which students and scholars can modify a cloud's configuration and perform simple experiments [17]. TeachCloud uses CloudSim as the basic design platform and introduces many new enhancements on top of it such as

1. Developing a GUI toolkit.
2. Adding the cloud workload generator to the CloudSim simulator.
3. Adding new modules related to SLA and BPM.
4. Adding new cloud network models such as VL2, BCube, Portland and DCell.

Table 1 : Comparison of Different Cloud Simulators

Simulator	Programming Language	Networking	Availability
CloudSim	Java	Limited	Open Source
GDC	C++/OTCL	Full	Open Source
Cloud Analyst	Java	Limited	Open Source
Network Cloud	Java	Full	Open Source
MDC	C++/Java	Full	Commercial

5. Introducing a monitoring outlet for most of the cloud system components.
6. Adding an action module that enables students to reconfigure the cloud system and study the impact of such changes on the total system performance.

L. SPECI Sim

Simulation Program for Elastic Cloud Infrastructures (SPECI) is a simulation tool which allows analyzing and exploration of scaling properties of large data center behavior under the size and design policy of the middleware as inputs. SPECI is a simulation tool which allows exploration of aspects of scaling as well as performance properties of future Data Centers. The aim of SPECI Sim is to simulate the performance and behavior of data centers, given the size and middleware design policy as input. Discrete event simulations (DES) are a type of simulation where events are ordered in time maintained in a queue of events by the simulator and each processed at given simulation time [8, 9]. SPECI uses an existing package for DES in Java. SPECI is intended to give us insights into the expected performance of DCs when they are designed, and before they are built. The size of data centers that provide cloud computing services is increasing, and some middleware properties that manage these data centers will not scale linearly with the number of components. SPECI is composed of two packages: data center layout and topology, and the components for experiment execution and measuring. The experiment part of the simulator builds upon SimKit, which offers event scheduling as well as random distribution drawing [9, 10, 12].

VII. COMPARISON OF VARIOUS VARIANTS OF CLOUDSIM

The number of simulation environments for cloud computing data centers available for public use is limited. The CloudSim simulator is probably the most sophisticated among the simulators overviewed. It is evolved as a built up on top of the grid network simulator GridSim developed at the University of Melbourne. The DCSim simulator is a relatively fresh data center simulator developed at the Pennsylvania State University in 2009. It is supplied with specific hardware characteristics of data server components such as servers, communication links and switches from different vendors and allows estimation of power consumption. Comparing cloud computing simulators via comparison of their characteristics such as platform, language, networking, Simulator type and availability but Most of these simulators are software based and are developed using Java. CloudSim is event-based simulators which avoid building and processing small simulation objects individually released under open source GPL license. Such a method reduces simulation time considerably, improves scalability, but lacks in the simulation accuracy. Summarizing, short simulation times are provided by CloudSim even for very large data centers due to their event-based nature.

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VIII. CONCLUSION

Cloud computing has been one of the fastest growing parts in IT industry. Simulation based approaches become popular in industry and academia to evaluate cloud computing systems, application behaviors and their security. Several simulators have been specifically developed for performance analysis of cloud computing environments including CloudSim, SPECI, GroudSim and DCSim but the number of simulation environments for cloud computing data centers available for public use is limited. The CloudSim simulator is probably the most sophisticated among the simulators.

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