A Study and Analysis on Simulators of Cloud Computing Paradigm

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Abstract: *Cloud computing is growing day by day and becoming popular in today's era. A large number of organizations are shifting their business on cloud and paying more attention towards the cloud. This scenario shows that before the adoption of cloud computing business model, there should be an evaluation. This evaluation can be done only with the help of the simulators. This paper presents the study and comparative analysis of existing cloud simulator and shows the comparison that helps the end user for selecting the suitable simulator.*

Keywords: *Cloud Computing, Cloud Sim, Cloud Analyst, Network CloudSim, EMUSIM, DCSim, iCanCloud, MDCSim, Green Cloud, SPECI, Teach Cloud.*

I. INTRODUCTION

N Cloud computing (CC) is on demand and convenient service providing business model. Due to the rapid growth of CC, it has become more popular in IT sector, business organizations, governance etc. It is very important for an organization from a security point of view before shifting their business on cloud [11]. There are many issues arising during this process. Therefore, there must be some tools for the user by which performance of that cloud can be checked. The performance can be measure in different parameters like cost, response time, throughput, security etc. It is possible only with the help of simulators. Because of use of simulators, user can get an idea to implement the process in the real world.. Like NS2 [8] is a network simulator which is used to check the packet delivery or failure, JADE is used for software agents for checking of communication between agents. There are some other simulators that are used in different research fields. Similarly, now we have the availability of cloud simulators. CC came in light of 2007, but it became familiar with research since 2010. Earlier there were none of the simulators were developed. These simulators are Cloud Sim, Cloud Analyst, Network CloudSim, EMUSIM, DCSim, iCanCloud, MDCSim, Green Cloud, SPECI etc,

Section 2 depict the explanation of all existing cloud simulators, section 3 describes the comparative analysis of all simulators. Finally, the paper concludes in section 4.

II. CLOUD SIMULATORS

This section describes all available simulators in the field of CC. The various cloud simulator presents in this environment are: Cloud Sim, Cloud Analyst, Network CloudSim, EMUSIM, DCSim, iCanCloud, MDCSim, Green Cloud, SPECI etc. Descriptions of all simulators are as follows:

2.1 Cloud Sim: Cloud Sim has been developed as CLOUDBUS projects in Australia. It was developed by GRIDS in University of Melbourne [2]. Cloud Sim is a modeling and simulation framework of large scale data centers, virtualizations and federated clouds. It is a layered architecture as shown below in figure 1.
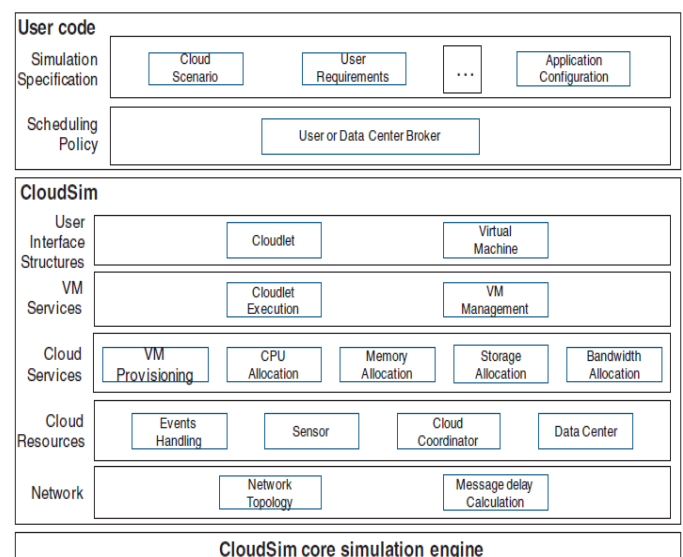

Fig. 1: Cloudsim Architecture[2]

Basically cloud simulator is used for **i**mplementing the resource provisioning algorithms existing in cloud environment. With the help of this simulator, a user can design a data center, virtual machine, and all kinds of network models. Using scheduling policy, the user can implement the resource allocation algorithm and evaluate the response time. It is executed on eclipse by importing jar files which exist in cloud sim. Once all jar files have been imported, user can execute the existing examples of cloudsim.

Cloud sim is limited to resource provisioning methods and it has no Graphical user interface (GUI).

2.2 Cloud Analyst: Cloud analyst is an extension of cloud sim. It presents graphical interface by which user can easily analyze the results. It gives efficient output and also has the capability to implement the algorithms by giving different input as parameters. Figure 2 shows that it is an extension of cloud sim [9]. It has one more layer added i.e (GUI) in the existing toolkit of cloudsim.
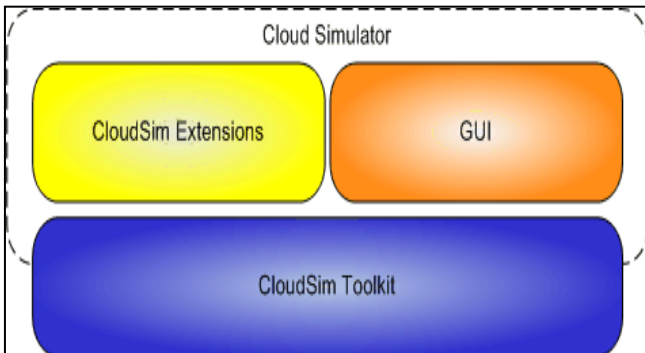

Fig. 2: Interaction between Cloudsim and Cloud Analyst [9]

Cloud analyst has an exe file, user just has to execute this exe file or it can be executed through command prompt. After executing, it shows the position of all data centers existing in the world.

2.3 DCSim: It stands for data center simulator. It is specifically used for managing data center and virtual machine (VM) management [8]. It is used to check the VM migrations, resource provisioning and to compare SLA violations. The architecture of DCSim is as given below:
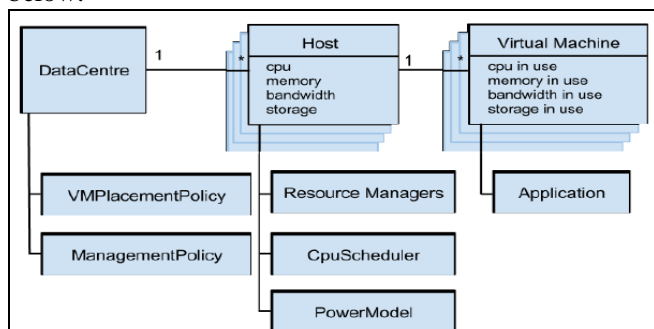

Fig. 3: Architecture of DCSim [8]

2.4 iCanCloud: This tool is also used for simulation and modeling in cloud computing. The main aim of this tool is determine the tradeoff between cost and performance of a cloud. The main feature of iCanCloud is that it is a GUI based tool and have the capability to implement existing and new brokering algorithms. It increases the functionality of simulation platform [3]. For installation of iCanCloud, OMNET++ and INET platform is required. The layered architecture of iCanCloud is given below:
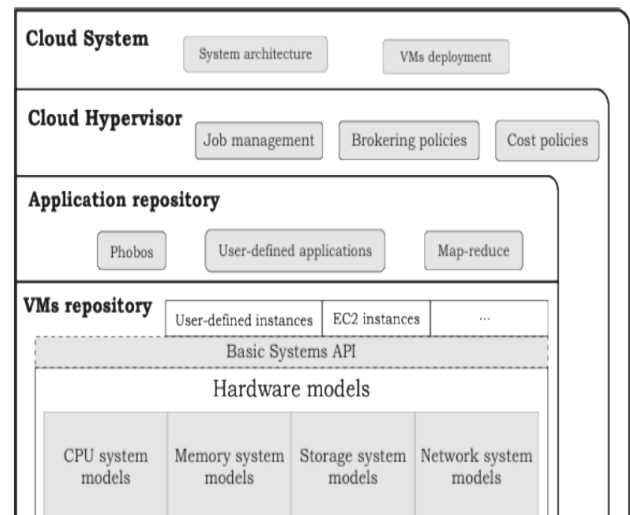

Fig. 4: Architecture of iCanCloud [3]

2.5 EMUSIM: It is meant by integrated emulation and simulation. It works in two phases: first is emulation and second one is simulation. This tool [5] is responsible to activate the all system components that will emulate during the execution. In the first phase of emulation the incoming requests and varying resource will be accommodate and second phase of simulation, the performance will be checked. The architecture of EMUSIM is as below:
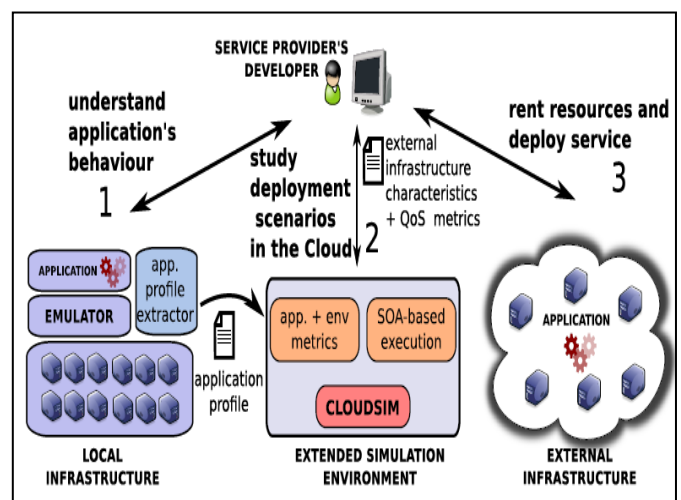

Fig. 5: Architecture of EMUSIM[5]

2.6 SPECI: It stands for Simulation Program for Elastic Cloud Infrastructure. It is a simulation tool that explores the scaling features and performance of data centers that. It uses the existing environment of discrete event simulation which is used to make model of a system. All experiments that implements in SPECI is based on SimKit which has the collection of event scheduling [11]. Using this tool user can setup a model and will do implementations in two packages. First package represents the layout of data centers and another contains the components for execution.

2.7 Green Cloud: It is developed by green cloud team in year 2013. It is basically used for energy consumption in cloud computing. Using this simulator, the user can easily simulate and do modeling of energy consumed in data centers [4]. It is extension of network simulator (NS-2). Language used for green cloud is C++ and Tool Command Language (TCL).
Next section depicts the comparison of cloud simulators.

III. COMPARISON OF CLOUD SIMULATORS

The below table shows the comparison of existing cloud simulator as discussed in above section.

Table 1. Comparative Analysis of Cloud Simulators

Cloud Simulator	User Friendly	Platform	Language	Open Source
Cloud Sim	No	Grid Sim	Java	Yes
Cloud Analyst	Yes	CloudSim	Java	Yes
DCSim	No	DES	Java	Yes
iCanCloud	Yes	OMNET++	NA	Yes
EMUSIM	No	AEF	XML	Yes
SPECI	Yes	SimKit	Java	Yes
Green Cloud	Yes	NS2	C++, TCL	Yes

Table 1 describes the comparative analysis among cloud simulators. It is up to the cloud user that which simulator will be chosen by him as per the requirement.

IV. CONCLUSION

With the rapid growth of cloud computing in today's era, keeping a check on performance becomes extremely important. This paper presented overall comparison among cloud simulators. Simulators make it easy for the user to decide amongst the clouds and take an appropriate decision finally adopting one. There are a number of simulators which exist for simulation of cloud like cloud sim, cloud analyst, DCSim, iCanCloud, EMUSIM, SPECI and Green Cloud which has been elaborated in this paper.

REFERENCES

[1] Bennett, C., Grossman, R., and Seidman, J., " Malstone: A Benchmark for Data Intensive Computing", Open Cloud Consortium Technical Report, 14 April 2009, pp 11-45.
[2] Calheiros, R. N., Ranjan, R., Beloglazov, A., Rose, A.F., Buyya, A., "CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource, ". Published in Software- Practice and Experience, Wiley Online Library, 2011, Volume 41, pp 23-50.
[3] Nunez, J.L. Vazquez-Poletti, A.C. Caminero, G.G. Castane, J. Carretero, I.M. Llorente, "iCanCloud: a flexible and scalable cloud infrastructure simulator", Journal of Grid Computing 10:1, 2012, pp 185–209.
[4] Nunez, J.L. Vazquez-Poletti, A.C. Caminero, J. Carretero, I.M. Llorente, "Design of a new cloud computing simulation platform", Proceedings of the International conference on Computational science and its applications, ICCSA'11, Santander, Spain, 2011, pp. 582–593.
[5] Rodrigo N. Calheiros1_y, Marco A. S. Netto2, C´esar A. F. De Rose3, Rajkumar Buyya, "EMUSIM: An Integrated Emulation and Simulation Environment for Modeling, Evaluation, and Validation of Performance of Cloud Computing Applications", Published in Wiley InterScience Softw. Pract. Exper. 2012, pp 1–18.
[6] Singh, A., Malhotra, M., "Analysis for Exploring Scope of Mobile Agents in Cloud Computing". In International Journal of Advancements in Technology Vol 3 No 3, pp 172-183.
[7] The Network Simulator Ns2, http://www.isi.edu/nsnam/ns/.
[8] Tighe, M., Keller, G., Bauer, M., Lutfiyya, H., "A Data Centre Simulation Tool for Dynamic Virtualized Resource Provisioning". Published in Western Science, 2012, pp 866-872.
[9] Wickremasinghe, B., "CloudAnalyst: A CloudSim-based Tool for Modelling and Analysis of Large Scale Cloud Computing Environments". Published In distributed computing project, csse dept., university of melbourne, pp 433-659.
[10] Zhang, Q., Cheng, L.:Cloud computing: State-of-the-art and research challenges. Raouf Boutaba J Internet Serv Appl (2010) 1: 7–18
[11] Zhao, w. Peng. Y., Xie, F., and Dai, Z., "Modeling and Simulation of Cloud Computing: A Review", 2012 IEEE Asia Pacific Cloud Computing Congress (APCloudCC), IEEE, 2012, pp 122-131.