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A Detailed Survey on various Cloud computing Simulators

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INTRODUCTION TO SIMLATORS

A) Cloud SIM

CloudSim is a new, generalized and extensible simulation toolkit and application which enables seamless modeling, simulation, and experimentation of emerging cloud computing system, infrastructures and application environments for single and internetworked clouds [2, 5, 6]. The existing distributed system simulators were not applicable to the cloud computing environment due to evaluating the performance of cloud provisioning policies, services, application workload, models and resources under varying system, user configurations and requirements.

With regard to complex composition and deployment requirements of Cloud computing services, it is difficult to evaluate the performance of Cloud's application and resource models under different systems and users' configurations. The CloudSim attempts to tackle with this problem by modelling the Cloud computing systems and their components such as datacenters, virtual machines etc. It is an extensible and easy to setup simulating framework for Cloud computing infrastructure and application services. Less efforts and times are needed to deploy Cloud based application experiments in CloudSim. It is able to model large scale Cloud environments on single node. It also supports the network topologies simulations and federated Cloud environments. It can create and manage multiple independent virtual services on one datacenter with the capability of working as space or time shared allocations [35].

CloudSim is a simulation application which enables seamless modeling, simulation, and experimentation of cloud computing and the application services, proposed by[7,8,9] due to the problem that existing distributed system simulators were not applicable to the cloud computing environment.

CloudSim goal is widely used for performing simulations in cloud. In case of cloud to access the infrastructures you need to pay some amount to the service provider hence using a simulator is easier as it allows users to perform repeated simulations with change in different parameters, free of cost for the application, infrastructure and platform services.

It is an extensible simulation toolkit that enables modeling and simulation of Cloud computing en- vironments [9]. The CloudSim toolkit supports modeling and creation of one or more virtual machines (VMs) on a simulated node of a Data Center, jobs and their mapping to suitable VMs [16]. It also allows simulation of mul- tiple Data Centers to enable a study on federation and associated policies for migration of VMs for reliability and automatic scaling of applications

There are several features of CloudSim such as: support for modelling and instantiation of large scale cloud computing infrastructure including data centres on a single physical computing node and java virtual machine; a self contained platform for modelling data centres , service brokers, scheduling and allocation policies, availability of virtualization engine, which aids in creation and management of multiple, independent and co-hosted virtualized services on data center node; and flexibility to switch between space- shared and time shared allocation of processing cores to virtualized services.[3]

CloudSim is a simulation application which enables seamless modeling, simulation, and experimentation of cloud compu- ting and application services [Calheiros et al., 2009; 2011; Buy- ya et al., 2009] due to the problem that existing distributed system simulators were not applicable to the cloud computing environment. Evaluating the performance of cloud provision- ing policies, services, application workload, models and re- sources performance models under varying system, user con- figurations and requirements is difficult to achieve. To over- come this challenge, CloudSim can be used. CloudSim is new, generalized and extensible simulation toolkit that enables seamless modeling, simulation and experimentation of emerg- ing cloud computing system, infrastructures and application environments for single and internetworked clouds. In simple words, CloudSim [Rahul Malhotra & Prince Jain, 2013] is a development toolkit for simulation of Cloud scenarios. CloudSim is not a framework as it does not provide a ready to use environment for execution of a complete scenario with a specific input. Instead, users of CloudSim have to develop the

cloud scenario it wishes to evaluate, define the required out- put, and provide the input parameters [Dr. Rahul Malhotra & Prince Jain, 2013].

CloudSim is invented and developed as CloudBus Project at the University of Melbourne, Australia. The CloudSim toolkit supports system and behavior modeling of cloud system components such as data centers, virtual machines (VMs) and resource provisioning policies. It implements generic applica tion provisioning techniques that can be extended with ease and limited efforts. CloudSim helps the researchers and developers to focus on specific system design issues without getting concerned about the low level details related to cloud-based infrastructures and services [Wickremasinghe, 2009]. CloudSim is an open source web application that launches preconfigured machines designed to run common open source robotic tools, robotics simulator Gazebo.

A) Cloud Analyst

Cloud Analyst: A GUI Based simulator supports the evaluation of social network tools according to the geographic distribution of users and data centers. Cloud Analyst provides powerful simulation framework via Map Interface for deploying real time data centers and monitoring load balancing, cloud cluster monitoring and data center data flow in real time.

CloudAnalyst was derived from CloudSim and extends some of its capabilities proposed in [12, 13]. This simulator can be applied to examining the behavior of large scaled Internet application in a cloud environment and separating the simulation experimentation exercise from a programming exercise. It also enables a modeler to repeatedly perform simulations and to conduct a series of simulation experiments with slight parameters variations in a quick and easy manner. The CloudAnalyst architecture is shown in Figure2 [5].

It is a tool to simulate large-scale Cloud applications with the purpose of studying the behavior of such applications under various deployment configu- rations [25]. CloudAnalyst helps developers with insights in how to geographically distribute applications among Cloud infrastructures and value added services, such as optimization of applications performance. It is based on the CloudSim platform and provides GUI feature to perform easier study of Cloud applications.

CloudAnalyst was derived from CloudSim and extends some of its capabilities and features proposed [Wickremasinghe, 2009; Wickremasinghe & Calheiros, 2010]. CloudAnalyst separates the simulation experimentation exercise from a programming exercise. It also enables a modeler to repeatedly perform simulations and to conduct a series of simulation experiments with slight parameters variations in a quick and easy manner. CloudAnalyst can be applied to examining behavior of large scaled Internet application in a cloud environment.

1. Easy to use Graphical User Interface (GUI
2. Ability to define a simulation with a high degree of con-figurability and flexibility
3 . Repeatability of experiments.
4. Graphical output
5. Use of consolidated technology and ease of extension

A) Network CloudSim

Network CloudSim is an extension of CloudSim as a simulation framework that supports generalized applications such as high performance computing applications, workflows, e-commerce and real cloud data centers modeling.Network CloudSim provides scalable and fast simulation. . Network CloudSim structure supports designing of the real Cloud data

NetworkcloudSim is an extension of CloudSim as a simulation framework that supports generalized applications such as high performance computing applications, workflows, and e-commerce besides real cloud data centers modeling proposed in [9]. The architecture of CloudSim-based NetworkCloudSim is depicted. Network Cloud is an extension of CloudSim and is capable of implementing network layer in CloudSim, reads a BRITE file and generates a topological network. Here, we have topology file which contains the number of nodes along with the various entities involved in simulation. In this simulation tool, each entity is to be mapped to a single BRITE node so that network CloudSim can work properly. Network CloudSim can be used to stimulate network traffic in CloudSim [4].

Network CloudSim is an extension of CloudSim as a simulation framework which supports generalized applications such as high performance computing applications, workflows and e-commerce [Buyya et al., 2009]. Network CloudSim uses Network Topology class which implements network layer in CloudSim, reads a BRITE file and generates a topological network. In network CloudSim, the topology file contains nodes, number of entities in the simulation which allows users to increase scale of simulation without changing the topology file. Each CloudSim entity must be mapped to one BRITE node to allow proper work of the network simulation. Each BRITE node can be mapped to only one entity at a time. Network CloudSim allows for modeling of Cloud data centers utilizing bandwidth sharing and latencies to enable scalable and fast simulations. Network CloudSim structure supports designing of the real Cloud data centers and mapping different strate- gies. Information of network CloudSim is used to simulate latency in network traffic of CloudSim. This simulation framework which supports the modelling of essential data center

resources such as network and computational re- sources, and wide variety of application models such as paral- lel application, workflow and parametric sweep.

D) EMUSIM

EMUSIM is having limitation regarding scalability due to either hardware constraints or difficulty in generating large and realistic workloads

EMUSIM is an integrated architecture proposed in [18] to anticipate service's behavior on cloud platforms to a higher standard, which is built on Automated Emulation

Framework (AEF) [25] for emulation and CloudSim for simulation [7] [5].

EMUSIM is an integrated architecture [Calheiros et al., 2012] to anticipate service's behavior on cloud platforms to a higher standard [Calheiros et al., 2011; Wei Zhao et al., 2012]. EMUSIM combines emulation and simulation to extract in- formation automatically from the application behavior via

sponding simulation model. Such a simulation model isthen used to build a simulated scenario that is closer to the actual target production environment in application computing re- sources and request patterns. Information that is typically not disclosed by platform owners, such as location of virtual ma- chines and number of virtual machines per host in a given time, is not required by EMUSIM. EMUSIM is built on top of two software systems: Automated Emulation Framework (AEF) for emulation and CloudSim for simulation.

E)Groud Sim

GroundSim, is an event-based simulator that requires only one simulation thread for scientific applications on grid and cloud environments. It mainly concentrates on the Infrastructure based service of cloud

GroundSim, proposed in [28], is an event-based simulator that needs just one simulation thread for scientific applications on grid and cloud environments. It is mainly concentrated on the IaaS, but it is easily extendable to support additional models like PaaS, or cloud storage [5].

More investigation was carried out in [19] in order to allow the user to simulate their experiments from the same environment used for real applications, by integrating

GroudSim into the ASKALON environment [20] [5

G)Dc Sim DCSim provides the additional capability of modeling replicated VMs sharing incoming workload as well as dependencies between VMs that are part of a multi-tiered application

DataCenter Simulator, proposed in [30], is concentrated on virtualized data centers, offering IaaS to Multiple tenants, in order to achieve a simulator to evaluate and develop data center management techniques.

H)MDC Sim

The MDCSim is a discrete event simulator developed at the the Pennsylvania state university in 2009 with hardwa re specification for different servers, communicat ions, connections and switches to estimate their power consumptions. It is a flexible and scalable simu lation platform for analyzing multi-tier datacenters

MDCSim is a commercial discrete event simulator devel- oped at the Pennsylvania State University. It helps the analyz- er to model unique hardware characteristics of different com- ponents of a data center such as servers, communication links and switches which are collected from different dealers and allows estimation of power consumption. MDCSim is the most prominent tool to be used as it has low simulation over- head and moreover its network package maintains a data cen- ter topology in the form of directed graph [Dr. Pawan Kumar & Gaganjot

Kaur].

I)Green Cloud

GreenCloud is an extens ion of packet-level s imu lator NS2 with the capability of evaluating the energy-aware Cloud datacenters. It is able to extract, aggregate, and make the informat ion about computing/communication ele ments' consumed energy

GreenCloud is an improvement in CloudSim to prove the green cloud computing approach. The lack of detailed simulators, and having no provisioning system for analyzing energy efficiency of the clouds was the motivation behind GreenCloud development to interact and measure cloud performance. It's an advanced packet-level simulator with concentration on cloud communication proposed in [16]. It provides a detailed fine- grained modeling of the energy consumed by the data center IT equipment such as computing servers, network switches, and communication links. GreenCloud is considered as an extension of the network simulator

It is a simulation environment for energy- aware cloud computing data centers based on the ns2 platform. The simulator is designed to capture details of the energy consumed by data center components (servers, switches, and links) as well as packet-level communica- tion patterns in realistic setups and workload distributions

This is a simulator which is used for developing solutions for monitoring, allocation of resources, scheduling of the workload on data centres in cloud. It efficiently provides modelling of the energy consumed by the data centres and IT

related equipments such as servers, routers, network related equipments etc. It supports independent energy models for each type of resource. It has a user friendly GUI interface and is open source tool.

Green Cloud is a Cloud Simulator that have green cloud computing approach with confidently, painlessly, and success-fully. In other words, GreenCloud is developed as an ad- vanced packet level cloud network simulator with concentra- tion on cloud communication [Kliazovich et al., 2010]. Green- Cloud extracts, aggregates and makes fine grained infor mation about the energy consumed by computing and com-munication elements of the data center equipment such as computing servers, network switches and communication links [Wei Zhao et al., 2012; http://www.isi.edu/nsnam/ns/] available in an unprecedented fashion. Moreover, GreenCloud offers a thorough investigation of workload distributions. In particular, a special focus is devoted to accurately capture communication patterns of currently deployed and future da- ta center architectures. GreenCloud can act as Cloud Bridge [http://gogreencloud.com]. In simple words, GreenCloud is the practice of designing, manufacturing, using and disposing computing resources with minimal environmental damage. The Green Cloud is a supercomputing project under active development at the University of Notre Dame. Green Cloud provides a virtual computing platform by using grid heating which reduces cluster upkeep costs.

J)CDO Sim

CDOSim is a cloud deployment option (CDO) Simulator which can simulate the response times, SLA violations and costs of a CDO. A CDO is a decisions concerning simulator which takes decision about the selection of a cloud provider, specific runtime adaptation strategies, components deployment of virtual machine and its instances configuration.

H) Teach Cloud

Teach Cloud 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

I) I Can Cloud

iCan Cloud is a software simulation framework for large storage networks. iCanCloud can predict the trade-off between costs and performance of a particular application in a specific hardware in order to inform the users about the costs involved It is a simulation platform which is oriented towards the simulation of a wide range of cloud com- puting systems and their underlying architectures [26]. It has the ability to model and simulate large environments (thousands of nodes) and distributed applications with a customizable level of detail. iCanCloud simulator uses the popular OMNET++ framework used for simulating computer networks.

J) SPECI

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 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.

Simulation Program for Elastic Cloud Infrastructures (SPECI) proposed in [15] based on [14] is a simulation tool, which allows analyzing large data center behavior under the size and design policy of the middleware as inputs. SPECI is composed of two packages: data center layout and topology, and the components for experiment execution and measuring. [5]

SPECI, S i m u l a t i o n Program f o r E l a s t i c C l o u d Infrastructures, is responsible for analyzing the various scalability and performance aspects of future Data centers. It is assumed that when data centers are made to grow big, then they do so in a non linear fashion, so there is a need to analyze the behaviour of such data centers. To analyze such a scenario SPECI is used

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Simulator	Provider	License	Category	API	OS	Services	Popularity	Comments
Eucalyptus	Eucalyptus Systems Inc.	Open source	Software Framework	Java/C	Linux, Windows	IaaS	10.00	AWS compatible Private Cloud
ns2	University of South California	Open source	Simulation Software	C++/OTcl	Linux	N/A	2.78	Extended in GreenCloud simulator
CloudSim	University of Melbourne	Open source	Simulation Software	Java	Linux, Windows, Mac	IaaS	2.50	Generalized and extensible framework
Opnet	Opnet Inc.	Paid	Simulation Software	C/C++	Windows, Linux	N/A	2.35	Limited application testing for Cloud
GreenCloud	University of Luxembourg	Open source	Simulation Software	C++/OTcl	Linux	IaaS	1.79	Based on ns2, focus on energy efficiency
OpenStack	Group of CompaNies	Open source	Software Framework	Python	Linux	IaaS	1.36	Compatible with Amazon Web Services
Open Cloud	Group of US Universities	Propriety Membership required	Scientific Testbed	Hardware based	Hardware based	IaaS, PaaS, SaaS	1.35	Appropriate for testing Cloud applications
Open Cirrus	Group of Universities and Companies	Propriety Membership required	Scientific Testbed	Hardware based	Hardware based	IaaS, PaaS, SaaS	0.34	Focus on testing Federated Cloud Datacenters
CloudAnalyst	University of Melbourne	Open source	Simulation Software	Java	Linux, Windows, Mac	IaaS	0.23	Extension of CloudSim with GUI
iCanCloud	University of Madrid	Open source	Simulation Software	C++	Linux	IaaS	0.09	Uses OMNET++ framework

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REFERENCES

[1] http://www.explainthatstuff.com/cloud-computing introduction.html.[Accessed (May 3, 2015)], "Woodford, Chris. (2009) Cloud computing."

[2]Mell, Peter and Grance, Tim, "The NIST definitioncomputing", National Institute of Standards and Technology, 2009,vol 53, p.50, Mell2009.

[3] http://www.davidakka.com/uncategorized/cloud-models-what%E2%80%99s-right-for-you/, "Cloud models what"s right for you".

[4] Marinos, Alexandros, and Gerard Briscoe, "Community cloud computing."Cloud Computing. Springer Berlin Heidelberg, 2009, pp.472-484.

[5]http://searchcloudcomputing.techtarget.com/definition/hybrid-cloud, "hybrid cloud".

[6]Kumar, Parveen, and Anjandeep Kaur Rai. "An Overview and Survey of Various Cloud Simulation Tools." Journal of Global Research in Computer Science , Vol 5(1) , pp: 24-26, 2014.

[7] Calheiros, Rodrigo N., Rajiv Ranjan, Anton Beloglazov, Cesar AF De Rose, and Rajkumar Buyya. "CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms. "Software: Practice and Experience 41, pp: 23-50, 2011.

[8] B.Wickremasinghe, "CloudAnalyst: A CloudSim based Tool for Modeling and Analysis of Large Scale Cloud Computing Environments", MEDC Project Report, 2009.

[9] S. Lim, B. Sharma, G .Nam, E. K. Kim, and C. R. Das "MDCSim: A Multi-tier Data Center Simulation Platform" Cluster Computing and Workshops, 2009.

[10] M. Shiraz, A. Gani, R. H. Khokhar, E Ahmed, "An Extendable Simulation Framework for Modeling Application Processing Potentials of Smart Mobile Devices for Mobile Cloud Computing", 10th International Conference on Frontiers of Information Technology,2012.

[11] S. Ostermann, K. Plankensteiner, R. Prodan, "Th. Fahringer, "GroudSim: An Event Based Simulation Framework for Computational Grids and Clouds", Euro-Par 2010 Parallel Processing Workshops Lecture Notes in Computer Science Volume 6586, pp: 305-313, 2011.

[12] Ahmed, Arif, and Abadhan Saumya Sabyasachi. "Cloud computing simulators: A detailed survey and future direction." In Advance Computing Conference (IACC), 2014 IEEE International, pp. 866-872. IEEE, 2014.