

# An Online Cloud Data Center Simulation System

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**ABSTRACT**—Currently, many researchers play more attention on cloud data center network and hope to verify their achievements. However, existing cloud data center simulation tools are difficult to provide an online cloud data center simulation. In this paper, we design an online cloud data center simulation system based on CloudSim and some extensions. This system support Browser/Server mode and some simple configuration can simplify the simulation process.

**Keywords**—cloud computing; simulation; cloudsim; cloud data center

## I. INTRODUCTION

Recently, cloud computing [1] has a very good development prospects. The major Internet companies are all building their own cloud platform. Those smaller companies for reasons of the cost, deployed their services on their trust company's cloud platform. When the cloud datacenter has great amount applications, how to optimize the deployment will become an important issue. Now we already had a lot of cloud datacenter optimization dispose algorithms to reduce the system consumption of CPU, memory and bandwidth. We used to experiments on real cloud computing environment (Amazon EC2, Microsoft Azure, Google App Engine). However, because the real cloud environment is very difficult to provide a large number of customizability cloud resources to quantify the performance of provisioning policies [2]. So, more and more researchers use the simulation tool. There are a number of simulators including CloudSim<sup>1</sup>, GreenCloud<sup>2</sup>, and MDCSim<sup>3</sup>.

But, these simulators do not provide an online simulation tool and it is not convenient to use. For example, when we use CloudSim to make a simulation experiment, we have to use JAVA and inheritance abstract classes in the CloudSim. Although CloudSim has the detail documentation that could help us to write programs to achieve simulation experiment, it is still increase the hard for the algorithm designer to simulation. For instance, when we need to quantify the performance of virtual machine allocation strategy, we must understand all the code related to virtual machine allocation, and then write our allocation policy implementation code. This is very unfriendly to many novices. What's more, the simulation results show of these simulators are not friendly. Among its many of the details of the results are not shown. We can't visually see the

quality of the algorithm and the performance bottleneck of the algorithm.

So, in our demo, we put forward an online simulation system based on Web Application which has a friendly UI interface and the intuitive results display interface. You can clearly see the quality of each algorithm and the problems among them. It is very convenient to configure the parameters of the simulation. In addition, because our cloud data center simulation is building in Web server and our Web server performance must be higher than the user's host very much, so the user does not need to consume any local resources could be efficient and quick to build their own simulation model, and then get results that they want. It is very convenient for the researchers to repeat a large number of cloud simulation experiments.

## II. DESIGN OF WEBCLLOUDSIM

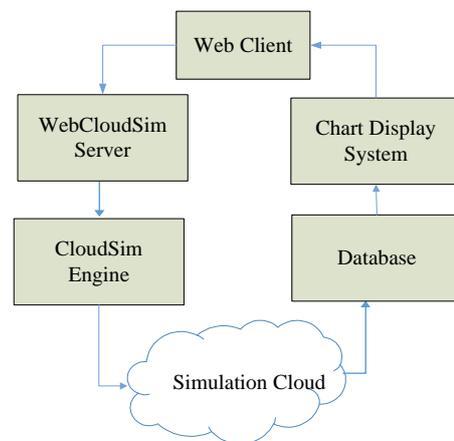


Figure 1. Overview of the WebCloudSim

In our online simulation demo, user needs to input the parameters of the cloud data center. And we pass these parameters to web server. Then we use CloudSim engine to generate the cloud data center simulation on our web server. When the end of simulation can we see the results view in the web page. More detailed function is introduced and implemented in the following. As shown in Fig.1, the overall view of our demo consists of six entities:

1) *Web Client*: This entity is an input interface for user. In this entity, we use a lot of web pages to collect user input in-

<sup>1</sup> <http://www.cloudbus.org/cloudsim/>

<sup>2</sup> <http://greencloud.gforge.uni.lu/>

<sup>3</sup> <http://gcclab.org/tagc/research/data-center.html>

formation. User can set most of the parameters of cloud data center here including the CPU, memory, bandwidth of each physical nodes and virtual machines in cloud data center and the data flow between the virtual machines and so on.

2) *WebCloudSim Server*: This entity is used to receive all the parameters entered by the user. It will first check the user input parameters` validity. If it don`t meet the requirements, it will return to the user. Then user sends a command to CloudSim Engine Layer to build simulation entities.

3) *CloudSim Engine*: This is an entity used to build simulation cloud data centers. We extended the basis of CloudSim. We have added VM Dependency module to CloudSim. In this module, we added the dependency between virtual machines. These dependencies are specified by the user. And we managed to virtual machines and perform tasks through these dependencies.

4) *Simulation Cloud*: This is a cloud data center that is simulated by CloudSim. After our expanded CloudSim engine receives user input parameters, according to the requirements of the parameters, simulating each module and the network topology of the cloud data center. Then it will generate some tasks in line with the test requirements, and schedule the virtual machine as well as tasks according to the selected algorithm. When the experiment running, from time to time to record the state of all the nodes in the cloud data center. And the data will be stored in the database.

5) *Database*: This entity is used to store the data from the Simulation Cloud. And it provides data support for the upper Chart Display System.

6) *Chart Display System*: This entity gets the data from the underlying database and drawn the beautifully charts to the user. Here the user can visually and timely observe the each node status in cloud data center and total system resources and energy consumption.

### III. DEMONSTRATION

In our demonstration, we can simulate the CPU, memory, bandwidth resources and energy consumption of the data center. Compared to other cloud simulator, our simulation engine is based on the background server. Thus, the performance of the simulation is not subject to the user's machine, which helps to shorten the time consumption for simulation.



Figure 2. The Resource Utilization for All VM. The X-axis represents time and Y-axis represents the utilization of resources.



Figure 3. The Cloudlets Number for each VM. The X-axis represents the name of each virtual machine and the Y-axis represents the number of cloudlets.



Figure 4. The Cloudlets Execution Time. The X-axis represents the ID of cloudlets and the Y-axis represents the cloudlets execution time. The below line represents the start time, the above line represents the end of time.

As shown in Fig.2, change trend of resource utilization over time and the maximum, minimum, and average value of the resource utilization. With the increase of time, all the global resource utilization is gradually reduced. This is good for our analysis of all kinds of resources scheduling and distribution policies in the process of the whole task execution. As shown in Fig.3, the each virtual machine assigned to the cloudlet number. It can be used to improve our cloudlet allocation algorithm. As shown in Fig.5, the execution time of all the tasks. We can see the start time and end time of each cloudlet execution. It is applied to analysis of the abnormal in the process of execution, and which part of the strategy has a problem.

This demo is just a prototype. There will be a lot of work to do. We want to join the virtual machine live migration deployment. And we need to do a better system to monitoring the simulation datacenter. It will also need to have the ability of data analysis to better help us to design our algorithm.

### ACKNOWLEDGMENT

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