International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Performance Analysis of Cloud Computing Machine

Saddam Ibrahim[1], Asim Karamaldeen[2], Zakieldeen Mohammed[3]

[1](School of Electrical Engineering, Xi^'n Jiaotong University, Xi^' n710049, China)
[2](School of Physical Sciences, University of Science and Technology of China, China)
[3](Electrical Engineering Department, Karary University, Omdurman 11111, Sudan)

ABSTRACT

Cloud computing is everywhere, a technology that delivers software, services, and online storage space. Cloud computing works with storage servers and generates enormous amounts of data. This has led to competition among companies to provide better services to users. This paper aims to study the performance of the unit used in the cloud computing environment by changing the various parameters that affect the unit's operation in relation to the cloud computing process. The study used Cloudsim, one of the most widely used simulation tools in cloud computing projects and research; Results showed that the performance measures for the unit's efficiency improve when a faster device capable of performing more instruction is used. Also, increasing the number of virtual Machines (VMs) would improve the overall performance.

Keywords: Cloud computing, Virtual Machine (VMs), Cloud SIM

Introduction

Think about a typical computer-based workday for you. How many of your computer resources do you use at the busiest times? About 10% of the CPU, 60% of the memory, and 20% of the network bandwidth are typically used by most users.[1] (That is during peak usage; on average, utilization levels during working hours are far lower) Nevertheless, you paid in full for all the resources when you purchased your computer. Because most Internet service providers (ISPs) have a lock-in period that ties you to their clientele for at least a year, your networking charges are also the same.[2] Would it not be beneficial to pool the underutilized computing capabilities of all the company's computers and put them to good use if your office has hundreds or even thousands of computers only used occasionally? In this manner, your business maximizes its investment. Now, let us apply the same logic to the data center, which houses many servers, including web servers, application servers, and database servers, all utilized similarly at low consumption rates. These might also have their hardware resources gathered and distributed across servers so you could use them more effectively.[1, 3]

There are many problems facing cloud computing, which we have discussed in this paper; the cost of using servers with available space and CPUs is prohibitive for most users. Additionally, we are only able to utilize some of the area. Since cloud computing can store enormous amounts of customer data, fulfilling their requirements as soon as possible was essential. In order to deliver the needed level of service to the end users, the system designers must have a precise understanding of the system's performance. The effectiveness of the individual machines has a significant impact on the system as a whole. Other traffic manipulation techniques, including route selection, forwarding, and buffering, are also known to harm performance. A collection of services offered by service providers (SP) through the Internet that allows clients to use those facilities and capabilities without having to buy costly hardware internally to do the same activities is known as cloud computing.

When service providers started utilizing virtual private networks (VPN) for data communication, the word "cloud" was first used in telecommunications.[4, 5] Cloud computing refers to computer, software, data access, and storage services that may not require the end user to know the precise location and setup of the system delivering the services. A recent development in IT is cloud computing, which involves moving computers and data from desktop and portable PCs to massive data centers.[6]

The definition of cloud computing provided by the National Institute of Standards and Technology (NIST) states: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage applications). Furthermore, services) that can be quickly deployed and released with minimal administration or interaction with the service provider.[7] With the global spread of the Internet, applications can now be delivered as services over the Internet. This reduces the overall costs. The NIST definition is currently the best, even though it requires upgrading, particularly in light of the three service models I will discuss later in this paper.

The remainder of the paper is organized as follows. Section 2 gives general information about cloud computing. Section 3 the Structure of the Cloud SIM program; and how it works. In Section 4, the operation and result discussion of the cloud computing machine. Ours summarized in Section 5, where we also outline the directions for future.

Layers of Cloud Computing

Infrastructure as a Service (IaaS): IaaS offers the basic building blocks of cloud computing, including virtualized on-demand access to processor, storage, and other lower-level hardware and network resources.

Platform as a Service (PaaS): PaaS goes one step beyond IaaS by giving users access to development and execution environments. An integrated platform for design, development, testing, and deployment is a PaaS solution. With only a few clicks, the PaaS customer may immediately deploy the apps into the provider's cloud infrastructure using the programming languages and APIs the provider supports.[8]

Software as a Service (SaaS): SaaS gives consumers access to fully functional turnkey programs through the Internet, including sophisticated systems like those for CRM or ERP. Once a user has subscribed, software or apps are housed in the cloud as services and distributed via browsers.[8] Using this method, the program will not need to be installed, executed, or maintained on local PCs. Fig.1. Explains the layers of cloud computing, with examples for each layer.

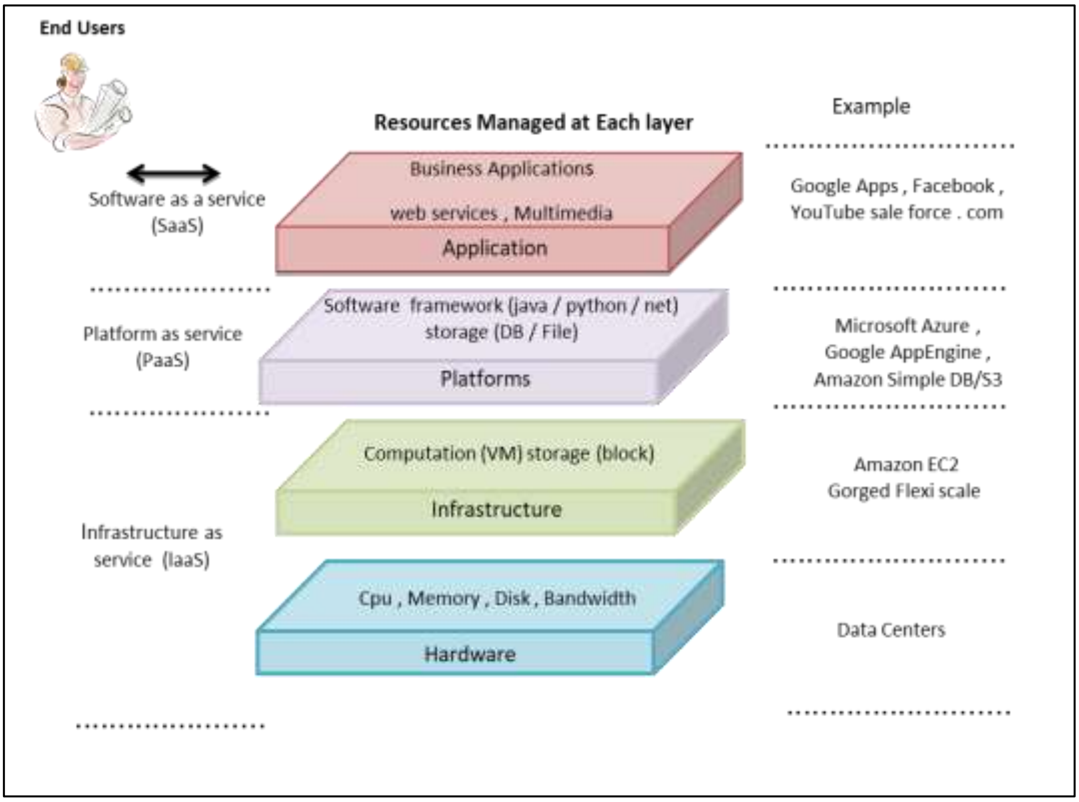

Fig.1 Layers of Cloud Computing

Cloud Sim

Using the free simulation tool CloudSim, cloud developers may test the effectiveness of their provisioning strategies in a repeatable and manageable setting. Before deployment in the actual world, it aids in tuning the bottlenecks. Since it is a simulator, no actual software is run by it. When technology-specific aspects are abstracted, it can be described as "running a model of an environment in a model of hardware."

A library for simulating cloud situations is called CloudSim. Data centers, computing resources, virtual machines, applications, users, and rules for controlling different system components, such as scheduling and provisioning, are all described in detail. With the aid of these elements, it is simple to assess new cloud usage regulations while considering policies, scheduling algorithms, and load-balancing policies. It may also be utilized to evaluate a strategy's effectiveness from other angles, including price, application execution time, etc. It also encourages the assessment of green IT regulations. It can incorporate additional policies for scheduling, load balancing, and new situations, and it may be used as a building component for a simulated cloud environment. Or as a library that enables you to add a desired scenario by creating a Java application since it is sufficiently adaptable .[9]

CloudSim enables organizations, R&D facilities, and industry-based developers to safely and efficiently test newly generated applications. Fig.2 outlines CloudSim's key characteristics.

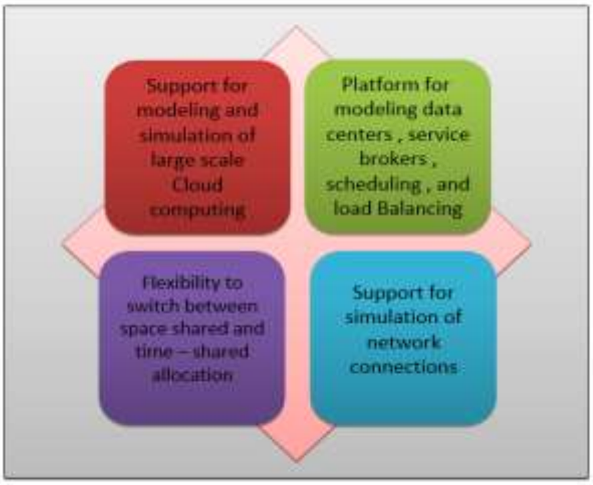

Fig.2 the prominent features offered by CloudSim

The architecture of CloudSim:

The CloudSim layer supports the modeling and simulation of cloud systems, and it includes specific management interfaces for memory, storage, bandwidth, and virtual machines. Along with managing application execution, provisioning hosts for virtual machines, and dynamic system state monitoring. At this tier, a cloud service provider can implement customized methodologies to evaluate the effectiveness of various VM provisioning practices. The user code layer exposes fundamental elements, including apps, VMs, applications, users, application kinds, scheduling policies, and basic information about machines, like their specs and numbers.

The core elements of the Cloudsim architecture

Cloud service providers divide their customers' resource requests into six geographic regions, corresponding to the world's six continents. These regions are used in cloud analysis. Infrastructure services offered by different cloud service providers are modeled by data centers, consisting of a collection of computing hosts or servers that can be either heterogeneous or homogeneous. Information models for resource setups in data centers are created to model physical resources such as storage or computing. A customer base serves as a model for a collection of users who are viewed as a single unit in the simulation, and its primary duty is to produce traffic for the simulation. The cloudlet specifies a list of user requests that includes the application ID, the name of the request originator's user base, the size of the command used to execute the request, and the input and output files. Cloud-based application services are modelled based on computational needs, with CloudSim classifying an application's complexity. The instruction length and data transfer overhead that each application service must perform during its life cycle are predetermined. The service broker (as shown in Fig. 3) chooses which data center should be used to fulfill customer support requests while provisioning policies for allocating VMs to hosts are simulated. The VM scheduler models the shared time or space while giving processor cores to VMs per a timetable.

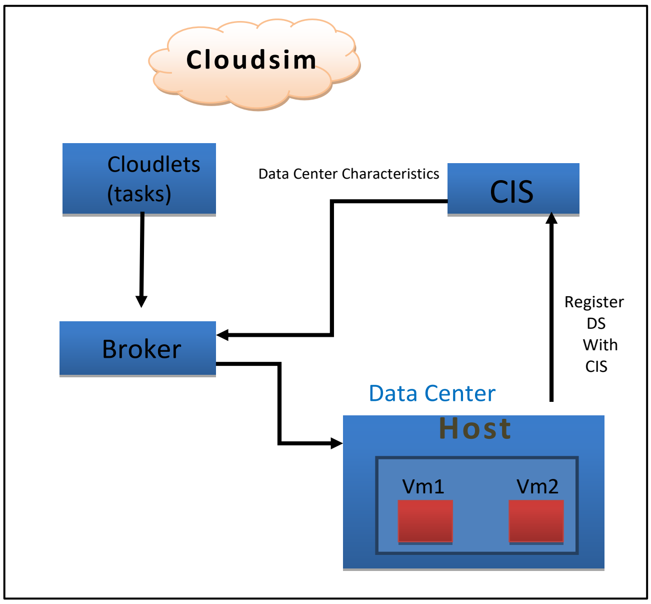

Fig. 3 CloudsSim Entities

Results and Analysis

A machine of cloud computing has been studied and analyzed. These instructions for handling the machine have various parameters that affect the operation of the cloud computing environment (Table (1-a)). The results of the study are presented in this section.

Machine Parameters and Description

Parameter	Value
VM Name	"Xen"
VM Identifier	0
Speed - Mega Instructions Per Second	1000 (MIPS)
Image Size	10000 (MB)
Number of Pes (number of CPUs)	1
Bandwidth	1000
VM description	Vm vm=new Vm(vm id,broker id, mips, pes Nember, ram,bw,size,vmm,new cloudlet scheduler timeShared());

Table (1-a) Machine Parameters and Description

The machine functions as a data center and a single Virtual machine.

Ten cloudlets were used to test the efficiency of the machine. It is noted that the processing took place in different periods of time for each cloudlet the more the number of times increased the processing time, and this is not effective for users, as illustrated by the results below Table (1-b).

The effect of the number of machines on the overall performance was tested by adding another VM Table (2- a) and Table (2-b). This was found to improve the efficiency of the system, reducing the processing time as will be seen later.

========== OUTPUT ==========

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time
0	SUCCESS	2	0	4000	0.1	4000.1
1	SUCCESS	2	0	4009	0.1	4009.1
2	SUCCESS	2	0	4017	0.1	4017.1
3	SUCCESS	2	0	4024	0.1	4024.1
4	SUCCESS	2	0	4030	0.1	4030.1
5	SUCCESS	2	0	4035	0.1	4035.1
6	SUCCESS	2	0	4039	0.1	4039.1
7	SUCCESS	2	0	4042	0.1	4042.1
8	SUCCESS	2	0	4044	0.1	4044.1
9	SUCCESS	2	0	4045	0.1	4045.1

CloudSimExample1 finished!

Table (1-b)

System with two Virtual machines:

Machine Parameters and Description

(A) The second virtual machine has a (MIPS) that is two times greater than the initial virtual machine:

Parameter	the initial virtual machine	The second virtual machine
VM Name	"Xen"	"Xen 2"
VM Identifier	1	2
Speed - mile Instruct–ons Per Second	250 (MIPS)	500 (MIPS)
Image Size	10000 (MB)	20000 (MB)
Number of Pes (number of CPUs)	1	1
Bandwidth	1000	2000
VM description	Vm vm=new Vm(vmid,brokerid,mips,pesNember,ram,bw,size,vmm,new cloudlet scheduler time Shared	Vm vm=new Vm(vmid,brokerid,mips,pesNember,ram,bw,size,vmm,new cloudlet scheduler timeShared

Table (2-a)

Parameter	the initial virtual machine	The second virtual machine
VM Name	"Xen"	"Xen 2"
VM Identifier	1	2
Speed - mile Instructions Per Second	1000 (MIPS)	500 (MIPS)
Image Size	10000 (MB)	20000 (MB)
Number of Pes (number of CPUs)	1	1
Bandwidth	1000	2000
VM description	Vm vm=new Vm(vmid,brokerid,mips,pesNember,ram,bw,size,vmm,new cloudletschedulertimeShared());	Vm vm=new Vm(vmid,brokerid,mips,pesNember,ram,bw,size,vmm,new cloudletschedulertimeShared());

Table (2-b)

(B) The initial virtual machine has a (MIPS) that is two times greater than the second virtual machine; in the results shown below (Table (2-c) and Table (2-d)), we notice the acceleration of machine processing compared to the initial machine is increased. We also note the effect of the elements (MIPS, BW, SIZE) on VM performance. The relationship between MIPS and the speed of VM is positive which means faster machines are characterized by higher MIPS.

Results

(A) The second virtual machine has a (MIPS) that is two times greater than the initial virtual machine

Table (2-c)

```
========== OUTPUT ==========
Cloudlet ID    STATUS    Data center ID    VM ID    Time    Start Time    Finish Time
    1        SUCCESS        2             2        800       0.1         800.1
    3        SUCCESS        2             2        800       0.1         800.1
    5        SUCCESS        2             2        800       0.1         800.1
    7        SUCCESS        2             2        800       0.1         800.1
    9        SUCCESS        2             2        800       0.1         800.1
    0        SUCCESS        2             1        1600      0.1         1600.1
    2        SUCCESS        2             1        1600      0.1         1600.1
    4        SUCCESS        2             1        1600      0.1         1600.1
    6        SUCCESS        2             1        1600      0.1         1600.1
    8        SUCCESS        2             1        1600      0.1         1600.1
CloudSimExample3 finished!
```

(B) The initial virtual machine has a (MIPS) that is two times greater than the second virtual machine

The system works using (4) Virtual Machines:

Table (2-d)

Parameter	Value
VM Name	"Xen"
VM Identifier	0
Speed - Mega Instructions Per Second	250(MIPS)
Image Size	10000 (MB)
Number of Pes (number of CPUs)	1
Bandwidth	1000
VM description	For(int i =1; i <= VmNumb ; i++) ; vm=new Vm (i,br okerid,mip s,pesNember,ram, bw , size, vmm,new cloudlet scheduler timeShared

At this stage, 3 VMs were added to the machine (Table 3), and it was found that the speed increased almost linearly with the number of machines (Table (3-a)). This is consistent with expectations. The effect of time-sharing and license-sharing in the distribution of cloudlets on VMs was also noticed.

Machine Description:

```
========== OUTPUT ==========
Cloudlet ID    STATUS    Data center ID    VM ID    Time    Start Time    Finish Time
    0        SUCCESS         2             1        400       0.1         400.1
    2        SUCCESS         2             1        400       0.1         400.1
    4        SUCCESS         2             1        400       0.1         400.1
    6        SUCCESS         2             1        400       0.1         400.1
    8        SUCCESS         2             1        400       0.1         400.1
    1        SUCCESS         2             2        800       0.1         800.1
    3        SUCCESS         2             2        800       0.1         800.1
    5        SUCCESS         2             2        800       0.1         800.1
    7        SUCCESS         2             2        800       0.1         800.1
    9        SUCCESS         2             2        800       0.1         800.1
CloudSimExample3 finished!
```

Table (3) Machine Description for (4) VM

```
========== OUTPUT ==========
Cloudlet ID    STATUS    Data center ID    VM ID    Time    Start Time    Finish Time
    0        SUCCESS         2             1        0        0.1      0.1
    2        SUCCESS         2             3        320       0.1         320.1
    6        SUCCESS         2             3        320       0.1         320.1
    3        SUCCESS         2             4        400       0.1         400.1
    7        SUCCESS         2             4        400       0.1         400.1
    4        SUCCESS         2             1        480       0.1         480.1
    8        SUCCESS         2             1        480       0.1         480.1
    1        SUCCESS         2             2        600       0.1         600.1
    5        SUCCESS         2             2        600       0.1         600.1
    9        SUCCESS         2             2        600       0.1         600.1
CloudSimExample3 finished!
```

Table (3-a)

Conclusions

In this paper, a machine was designed to study the performance of a cloud computing system. This machine has elements that affect its performance (HOST, VM, CIS, BROCKER, CLOUDLETS). It is the cornerstone of building a cloud computing machine.

The results found that machine efficiency and speed depend heavily on MIPS and VMs. In the initial design of the machine with one VM, the slow time was observed in the implementation of cloudlets, but when adding another VM the speed increased significantly, and the effect of the MIPS value on the implementation priority was observed.

The machine in its final form contains 4 VM and high MIPS value; it has increased its efficiency and speed.

The study did not care about the priority of implementation of cloudlets for what the user wants. Scheduler policies were interested in distributing cloudlets on VM by timeshare and space shared without being subject to the priority of the user request.

References:

[1] A. Oram, Peer-to-Peer: Harnessing the power of disruptive technologies. " O'Reilly Media, Inc.", 2001.

[2] R. Kenny and A. Dennis, "Consumer lock-in for fixed broadband," Communications Chambers, 2013.

[3] B. Han, V. Gopalakrishnan, L. Ji, and S. Lee, "Network function virtualization: Challenges and opportunities for innovations," IEEE communications magazine, vol. 53, no. 2, pp. 90-97, 2015.

[4] G. Gala, G. Fohler, P. Tummeltshammer, S. Resch, and R. Hametner, "RT-cloud: Virtualization technologies and cloud computing for railway use-case," in 2021 IEEE 24th International Symposium on Real-Time Distributed Computing (ISORC), 2021: IEEE, pp. 105-113.

[5] A. Korty, D. Calarco, and M. Spencer, "Balancing risk with virtual private networking during a pandemic," Business Horizons, vol. 64, no. 6, pp. 757-761, 2021.

[6] B. Varghese and R. Buyya, "Next generation cloud computing: New trends and research directions," Future Generation Computer Systems, vol. 79, pp. 849-861, 2018.

[7] F. Shahzad, "State-of-the-art survey on cloud computing security challenges, approaches and solutions," Procedia Computer Science, vol. 37, pp. 357-362, 2014.

[8] D. C. Marinescu, Cloud computing: theory and practice. Morgan Kaufmann, 2022.

[9] A. Cloud Computing, "Practical Approach by Anthony t Velte Toby J Velte," Ph. D, Robert Elsenpeter, Tata McGraw Hill edn, 2010.