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A Simulation-Based Approach to Analyze CPU Debt in a Cloud

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Abstract

Cloud is an Infrastructure which provides the services according to the need of the user. Cloud computing is considered a high value and try to make systems with lower costs, higher benefits; for large-scale industry. Cost optimization concerned with CPU Debt and quality of service are two important aspects of cloud computing. So in this paper we are using a simulation tool CloudSim which is an open source code simulation framework, it helps in modeling and simulation of a cloud environment. From a simulation tool, we may obtain the minimal CPU Debt which in turn leads to cost optimization in a Cloud Computing Environment.

Keywords: Cloud, Cloud Computing, CPU Debt, Quality of Service.

1. INTRODUCTION

A basic definition for cloud computing, use the Internet to perform tasks as you do on your computer machine. So cloud computing is also defined as internet computing which provides as you need services which are shared resources, data, tools and other application services are provided upon to the client needs with minimal effort at a dedicated time[1]. Cloud computing follows running computer or network or applications that are on other people's sites using a simple user interface or application format. In a last years, cloud computing is decided as the most effective technology for its flexibility in deploying and scaling applications which are derived from virtualization, distributed components around various sites.[2].

1.2. Brief History of Cloud Computing

Cloud computing has become one of most Bright word. It is not a brand new revolution. It may be related to these idioms: utility, distributed, grid and cluster computing [5] as shown in figure [1]. Utility computing is a business computing model which is providing computing resource user gets and uses the computing resource from a service provider and pay for each real resource use. So, it is a Pay for use model based on resource usage quantity. Most data centers are not continuously used, with resources often idle 85 percent of the time. So the main benefit of utility computing is the economic reasons. [20]. Distributed computing operates with hardware and software systems containing more than one processing unit or storage unit, concurrent operations, or multiple programs, that running under a loosely or tightly controlled regime. Higher bandwidth and lower cost bring people to work in distributed computing by using the internet and communication medium for sharing resources [20]. Grid computing is a term for either of two broad subcategories of distributed computing: 1 online computation or storage

offered as a service which is supported by a pool of distributed computing resources. Data grids provide controlled sharing and management of large amounts of distributed data. 2 The induction of a "virtual supercomputer" merge in a network of loosely-coupled computers that acts concretely to perform very large tasks [4]. In grid computing each node will perform a different tasks rather than the others, so this technology has been applied to huge computation scientific, and research problems through volunteer computing [14].

In the case of cluster computing, A computer cluster is a group of computers is connected and working together similarly, with tow nodes or more, one node active and the others is passive, when the active node is gone to down state one passive node will be sit to up and working normally [4][5]. The cluster benefit to achieve availability and to improve the performance.

The paper is organized as follows:

In section 2, what is the virtualization; Section 3 describes the related Terminologies. Section 4 is talking about simulation workflow. And in section 5, we have given test and simulation part. At the last, section 6 concludes the work and give suggestions.

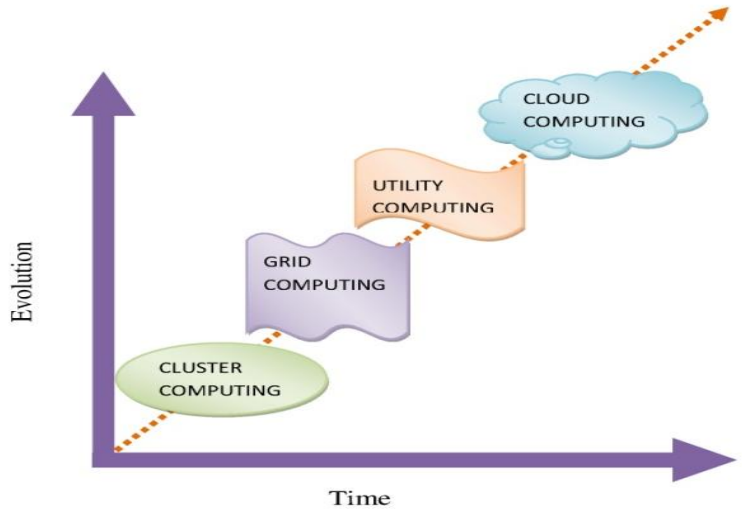

Figure1: Evolution of Cloud Computing

2. VIRTUALIZATION

Virtualization is the important feature of cloud computing [15][23]. This technology provides an abstract computing platform by adumbrating the physical characteristics of a computing platform from users. Virtualization technology provides a network access on-demand to a set of hardware, processors, memory, storage, and bandwidth and making new individual Virtual Machines (VM) [5]. Physical resources can be divided and converted into virtual or logical resources as user need due to virtualization [7].

2.1. Area of Virtualization

The term virtualization has become a Famous, bright Word, and as a result the term is now merge with a number of technologies include:

Storage virtualization: the imagen of storage devices into what appears to be a one storage unit.

Server virtualization: dividing a physical server machine into multiple smaller virtual machines.

Operating system virtualization: a type of server virtualization technology which works at the operating system layer, on the top of the OS kernel layer.

Network virtualization: segment a network resources through a logical segmentation of a single physical network.

Virtualization can also be categorized into two types. 1. Full Virtualization: it shares a computer system between many users, each user is separated from each other users. [18]. 2. Para Virtualization: it allows multi operating systems to run on a single computer by using a system resources effectively, so here all the services are not available, so the services are provided partially.[18][7].

3. RELATED TERMINOLOGIES

In this section, we have discussed some terminologies related to our simulation-based approaches which are as follows:

Host machine: It models the physical machine and joins information provided by the processing unit, main memory virtualization monitor specification, and disk and network bandwidth. It also specifies the information about the scheduling policies for control and processing unit, disk, network and main memory to virtual machines [13].

Virtual machine: VM is an application software Applied on a computing machine that perform Instruction as like as a real computer. It is running on a Host, and it uses the host resources and share it with other VMs. It processes cloudlets. This processing happens depended on a policy defined by the Cloudlet Scheduler. Each VM has an owner, and used separately from each other VM. [6][13].

Cloudlets: It models the application services. It encapsulates the number of instructions will be executed, and the amount of disk transfer to maintain the task [6][13].

QoS (Quality of service): Is the guarantee of computing process provided by Cloud computing, e.g. CPU speed, I/O bandwidth, and memory size. QoS is processed by making Service Level Agreement (SLA) with users, and it is an agreement depend on aspects as levels of availability, serviceability, performance, operation, or other items of the service like service fees and other services provided by provider. [19].

CPU debt: The debt in CloudSim is kept coarse-grained and in particular, it is just a basic calculation mechanism. It counts the used memory and bandwidth, multiplies these with a constant, and returns the resulting value.

Cost optimization: Cost optimization is defined of finding alternative with the most cost effective or highest achievable performance under the given conditions, by maximizing needed factor and minimizing undesired ones.

4. SIMULATION WORKFLOW:

Here, we have briefly discussed our simulation workflow as shown as figure [2], and we are going to describe our sequence diagram stepwise as follows:

STEP 1-Cloud user assigns the tasks to cloud broker.

STEP 2-Cloud broker divide the tasks into the same sized cloudlets.

STEP 3- Cloud broker sends the tasks virtual machine manager.

STEP 4- The cloud information service registry registered with each datacenter entity.

STEP 5-Cloud broker take a consultation from the Cloud information service (CIS) to find list of cloud providers, who can offer infrastructure services that matches application's QoS.

STEP 6-The cloud broker gets information about the availability of the data center from the CIS.

STEP 7- Virtual machine manager (VMM) creates the virtual machine.

STEP 8- Data Center entity calls a method called updateVmprocessing() for each host that manages it as a processing of task units is handled by VMs ,so their progress must be updated and monitored continuously.

STEP 9-At the host level, call of updateVMProcessing() begins an updateCloudletProcessing() method that directs every virtual machine to update its task unit status (finish, suspend, executing) with the Datacenter entity.

STEP 10- virtual machine returns the next expected time of completion specific task units currently managed by them.

STEP 11- The Datacenter entity receive the least completion time among all the computed values.

STEP 12-Request for execution of the cloudlet is sent to the virtual machine by VMM.

STEP 13- sends the executed cloudlets to the VMM.

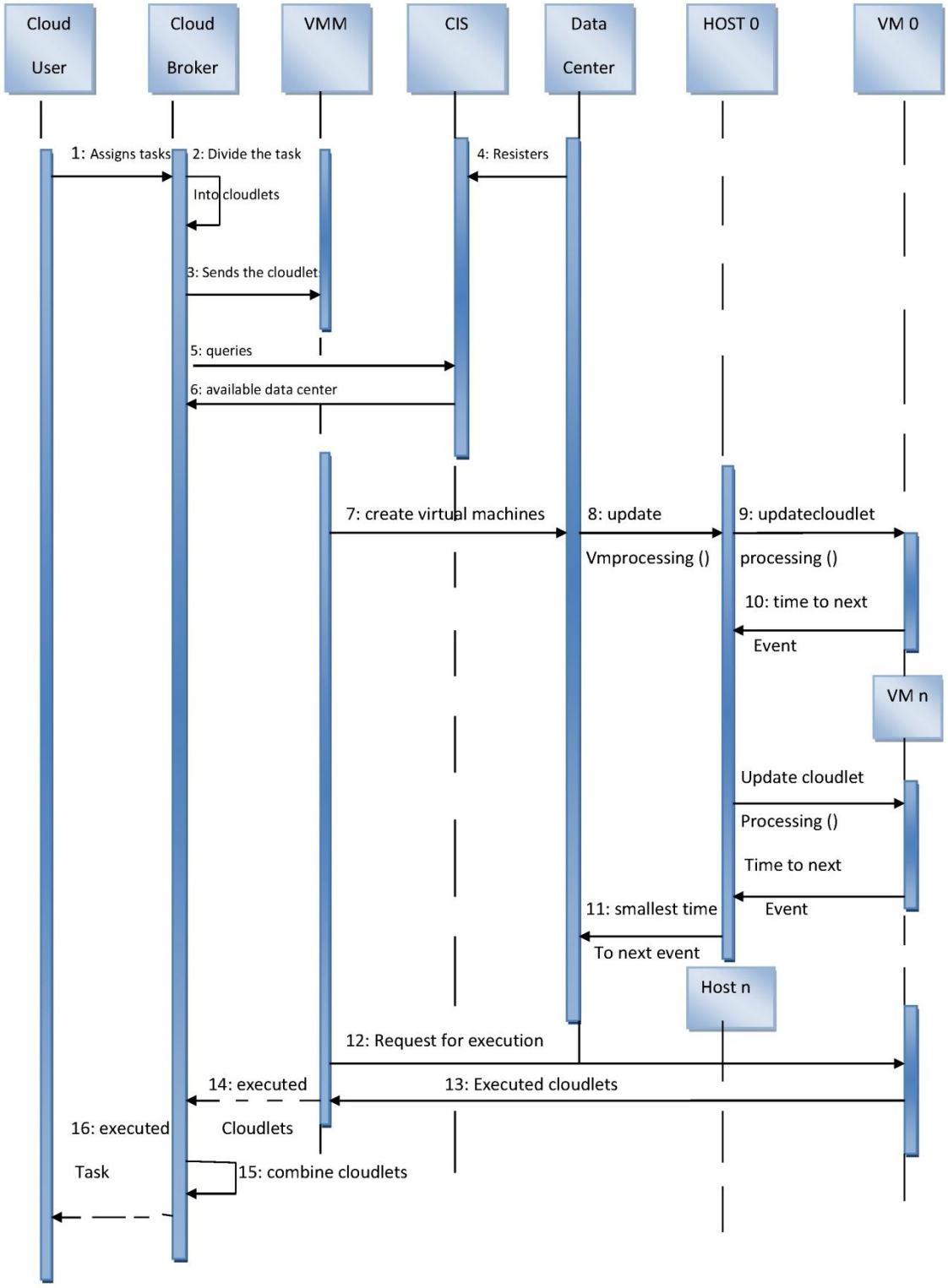

Figure2: Sequence Diagram of Simulation Workflow

STEP 14- VMM further passes the executed cloudlets to cloud broker.

STEP 15- Cloud broker combines all the executed cloudlets together to form the task.

STEP 16- Cloud broker sends the executed task back to the user.

5. TEST AND EVALUATION

Here, going to present test and evaluation that is involved in CPU Debt which is proportionate to cost expenditure by the cloud user that in turn meets the Quality of Service (QoS) of the Cloud computing Provider. The tests were conducted on a 32-bit Intel Core i5 machine having 2.60 GHz and 3 GB RAM running windows 7 Professional and JDK 1.6. The main goal of our tests is to evaluate the CPU Debt when the numbers of CPU cores as VM parameters vary from 1 to 8. And according to that variations, we are going to find in an optimized situation where CPU Debt is minimum.

We have used Eclipse Java EE IDE for Web Developers, Version: Juno Service Release 2 and CloudSim version 3.0 for simulation purpose. In our experimental setup, this the simulation works only when simulation is paused for 5 sec and this simulation creates a data-center Broker dynamically. And also subject to other constraints this Simulation is done.

The simulation environment consists of two hosts; each host has been modeled to have 1000 MIPS, 16 GB of RAM memory, 1 TB of storage and 10 numbers of VMs each of which has been modeled to have 500 MIPS, 1 GB of RAM, and 10 GB of image size. And also a datacenter is created, which has the characteristics like x86 of architecture, Linux as an operating system, Xen as VMM. The simulation uses Vm Allocation Simple as VM Allocation Policy, which chooses, as the host for VM, the host with less processing elements in use.

Figure3: Evaluation of CPU Debt.

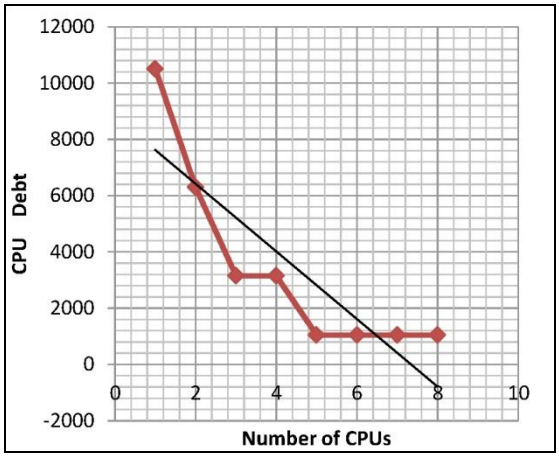

Figure3: Evaluation of CPU Debt

Here we present our simulation work which provides a platform where we can say that if we change the number of CPUs as VM parameters as shown in the figure [3], the related CPU Debt will decrease accordingly and when the number of CPUs varies from 5 to 8, CPU Debt will be same. In this experimental model, we can say that Cloud Provider don't need to use the maximum number of CPUs, rather than they are using less number of CPUs as VM parameters in their cloud infrastructure, and CPU debt will be the same. In turn, the cloud users don't need to invest a huge amount of money which leads to cost optimization from the enterprise point of view.

6. CONCLUSION AND FUTURE WORK

Rapid usage of Internet over the world, Cloud Computing has placed itself in every field of IT industry. The recent efforts and research to make cloud computing technologies better, which includes Quality of Service (QoS) and executing time, we have focused on those special facts in this paper. Therefore, we have concentrated on simulation-based approaches which help the cloud developers to test the performance of their service delivery policies and also their VM provisioning so that the cloud service providers can provide better quality services with minimum cost. At the end of our work, we can conclude that our sequence diagram and our simulation results may help to grow in cloud infrastructure in a dash of fast-growing usage of internet. Some other issues like power consumption in a different simulation environment, different service policies, VM migrations are left as the future work.

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