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Efficient Cost Scheduling algorithm with Load Balancing in a Cloud Computing Environment

Amanpreet Chawla, Navtej Singh Ghumman

Department of Computer Science and Engineering, SBSSTC, FZR, Punjab, India

ABSTRACT: Cloud computing is a very popular paradigm in the field of computer science. It provides on demand, ubiquitous access as a service to different people via the internet. In spite of offering many benefits over the traditional computing, there are numerous issues in cloud computing . Load balancing is one of the issue in cloud computing that distributes the workload to the nodes in such a way no one node is overloaded or under - loaded. In this paper, cost scheduling algorithm is applied for load balancing by considering the cost of service provider and user. In the cost scheduling algorithm, efficient mapping of tasks to available packages in cloud so it beneficial to user and service provider.

KEYWORDS: Cloud Computing, Load balancer, Virtual machine.

I. INTRODUCTION

Cloud computing is one of the latest paradigm in the field of computer science where heterogeneous services such as applications, servers and storage are delivered to an organization's computer and devices through the Internet. It is called ubiquitous computing that can be access anywhere anytime.

Cloud computing system can be deployed in different ways called deployment models. There are many development models of cloud computing such as public cloud, private cloud, hybrid cloud, community cloud. Private cloud will be deployed in single organization and public cloud offers the hosted the services to general public via the network. Hybrid cloud is combination of public and private cloud that remain unique entities but are bound together offering the advantages of multiple deployment models A community cloud is formed when several organizations with similar requirements share common infrastructure. There are some service models like software as a service and platform as a service and infrastructure as a service that provides services to different users. Infrastructure as a Service (IaaS), which provides the hardware to users on rent basis for various purposes. In case of platform as a Service (PaaS), environment is provided to the client so they can develop, debug, deploy the applications on this platform. In case of software as a service(SaaS), users don't need to install or upgrade any software.

A. Benefits and Barriers of Cloud Computing

There are some benefits of cloud computing that are:

a) *Scalability*: Scalability is the capability of a system to increase total throughput under an increased load when resources are added. Resources can be servers, hardware, storage, and network. The user can be scale up or scale down the resources in the cloud computing according to their need without buying the resources.
b) *Virtualization:* In cloud computing, virtualization is a concept where users have a single view of available resources irrespective of their arrangement in physical devices. So it is advantageous for the providing the service towards users with less number of physical resources.
c) *Mobility:* It provides mobility because users can access applications anywhere through the internet.
d) *Low Infrastructure Costs*: The pay-per-usage model is supported in cloud computing. It actually helps an organization to pay for the resources they need, not to make any investment for the resources available in the cloud. Moreover, the provider does not require any infrastructural maintenance or upgrade costs.

Thus, the cloud computing provides several advantages with form of elasticity, availability and expandability on-demand. Still it has some constraints or limitations as discussed in the following:

a) *Requires a constant Internet connection:* Cloud computing is impossible if you cannot connect to the Internet.
b) *Slow speed of Internet :* Uploading and downloading of large documents may take a long time.

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Figure 1 shows the different features and types and models of cloud computing. Some benefits and features of cloud computing are mobility, cost efficiency, virtualization and easy to use but there are some issues in cloud computing like load balancing, trust management, privacy, security and task scheduling.

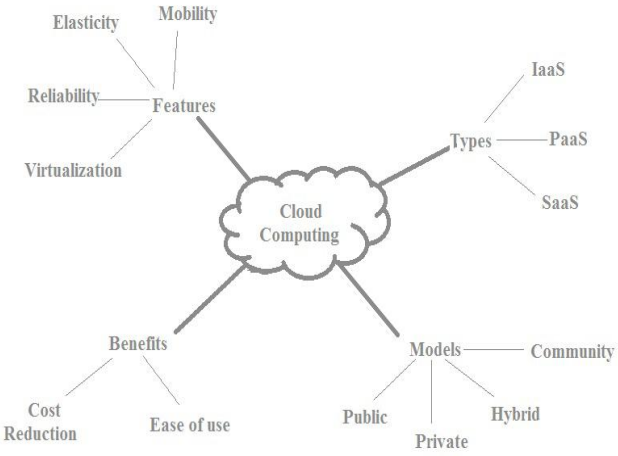

Figure1. Cloud Computing

Load Balancing is the one of the issue in cloud computing. It is a process of reassigning the total load to the individual nodes of the collective system to make resource utilization effective and to improve the response time of the task, simultaneously removing a condition in which some of the nodes are under loaded while some others are over loaded. It helps in effective resource utilization and improves response time of the task.[1]

II. LITERATURE SURVEY

In this section, we briefly summarize the load balancing algorithms used in the cloud computing environment. The main focus is on the efficient utilization of the resources and balancing the virtual machines with the incoming request.

Shridhar G.Damanal and G. Ram Mahana Reddy [3] have proposed the VM-Assign load balance algorithm which allocates the incoming requests to the all available virtual machines in an efficient manner. This algorithm focuses mainly on finding out the least loaded virtual machine and how incoming jobs are allocated intelligently. In this , the performance is analyzed using Cloudsim simulator and compared with existing Active- VM load balance algorithm

Vishwas Bagwaiya, Sandeep k. Raghuwanshi [4] have developed the Hybrid scheduling algorithm that can maintain the load and provides modified resource allocation techniques. In this Hybrid approach is applied for load balancing using Throttled and Equally Spread Current Execution (ESCE) algorithms. It contains the excellence of both ESCE and Throttled algorithms.

L.D. Dhinesh Babu , P. Venkata Krishna [5] have developed the honey bee behaviour inspired load balancing algorithm is used to balance the workload across virtual machine to maximize the throughput and also balance the priorities of task on machines in such a way that waiting time of task in queue is minimal. HBB-LB is derived from the behavior of honey bees for finding and reaping food. Task are removed from overloaded VM, upon submission to the under loaded VM, the task will update the number of various priority tasks and update the load of that particular VM to all other waiting tasks.

Kumar Nishant, Pratik Sharma, Vishal Krishna, Nitin and Ravi Rastogi [6] have developed the ACO algorithm for load distribution of workloads among nodes of a cloud by the use of Ant Colony Optimization (ACO).ACO is inspired from the ant colonies that work together in foraging behavior. The ants work together in search of new sources of food and simultaneously use the existing food sources to shift the food back to the nest. These Ants along with their traversal will be updating a pheromone table, which will keep a tab on the resources utilization by each node.

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Raza Abbas Haidri , C. P. Katti, P. C. Saxena have proposed efficient load balancing algorithm which ensures a fair distribution of loads among virtual machines and better resource utilization. It balances the loads coming from several users among datacenters and it offers better resource utilization and high availability in the form of improved response time and turnaround time

Yogita Chawla1 , Mansi Bhonsle [7] have proposed scheduling approach in cloud employs a dynamically optimized cost-based task scheduling algorithm for making efficient mapping of tasks to available resources in cloud. It aims to combine cost based task scheduling beneficial to user and dynamically optimized resource allocation strategy beneficial to service provider. It also improves computation/communication ratio and utilization of available resources by grouping the user tasks.

Mrs. Nagamani H. Shahapure, Dr. Jayarekha P [8] have proposed the Load Balancing with Optimal Cost Scheduling algorithm. In this proposed algorithm the workload is distributed evenly across all the hosts in the cloud to avoid a situation where some nodes are heavily loaded while the others have hardly any work. It is one of the Resource Scheduling Algorithm that optimizes the cost and schedules the resources based on the cost.

III. COST SCHEDULING ALGORITHM

In this algorithm, the workload is distributed evenly across all the hosts in the cloud to avoid a situation where some nodes are heavily loaded while the others have hardly any work. It is one of resource scheduling algorithm that optimize the cost and reschedule the resources based on cost. It helps to achieve the user satisfaction and resource utilization.

In the existing algorithm, each resource have separate VM. Whenever client request for two resources , two VM's were processed. It increased the cost of service provider. In the cost scheduling algorithm, authors proposed a algorithm that resources are grouped into package in each VM. each VM contains service pack. Whenever client request for resources, the VM consist that package is executed that saves the cost of service provider. Clients request for a resources and clients handles according to priority .Higher priority job are firstly executed on the VM consisting that package.

The VM's having the package. Resources are grouped into package. User sends the request for a specific package and broker Checks the VM consisting that package. if the VM is idle then broker allocate that VM to user for the processing. If VM is busy then user waits for their turn.[7,12]

Variables	Meaning
R_i	The available cloud resources
VM_i	The available virtual machines
C_i	The price fixed for VMi executing Ri
u_cost	The cost of the user for getting the service
e_cost	The cost taken by VM to serve the user
Pr_i	Profit at the provider for executing the resource
I	Number of instances, ranging from 1 to n
P	Processor
Pkg	Resources grouped into packages

The Cost of execution depends on the package Pkg containing the resource R executing on VM.

Algorithm:

if (P[i]==0) [Check the processor status , if it is idle]

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Processor status= 1; [Set processor status as ready]
u_cost = u_cost[i]; [initialize the user cost]
e_cost = cost of VM and Pkg * u_time; [Calculate the actual cost]
Pr = u_cost - e_cost; [Calculate the profit]
By using this algorithm both cloud provider and cloud users are benefited.
The profit at the service provider can be calculated as:
u_cost = ∑ u_cost (VM)/sec; [user pays according to the package selected]
e_cost = ∑ e_cost (VM)/ sec; [actual cost involve in executing]

$$\sum_{n=1,2..n}^{n} profit = \sum_{n=1,2..n}^{n} (u\_cost - e\_cost)$$

IV. SIMPLE ALGORITHM

In this algorithm, the cloudlets are assigned to virtual machines (VM's) on the basis of time slices. Here the time is divided into multiple slices and each node is given a particular time slice or time interval . it utilizes the principle of time scheduling. Each node is given a quantum and in this quantum the node will perform its operations. The resources of the service provider are provided to the requesting client on the basis of this time slice. After the time slice is over, the next queued user request will come for execution. user tasks are scheduled to virtual machines for some quantum of time one by one. The time slice expires, machine is given to the next task.

V. SIMULATION / EXPERIMENT DETAILS

A CloudSim simulator was used to test the algorithm. The simulator consists of cloud components like Virtual Machines (VM), Data Center (DC), Host and Cloudlet. The configuration for the different components (Bandwidth, MIPS (Million Instruction per Second), Cost, RAM size etc is mentioned.

Features of CloudSim

Different kinds of functionalities of CloudSim are presented in the following .

- Support for modelling and simulation of large scale cloud computing data centers.
- Support for modelling and simulation of virtualized server hosts, with customizable policies for provisioning host resources to virtual machines.
- Support for modelling and simulation of energy-aware computational resources.

Modules

a) *Virtual Machines:* Each data center consists of virtual machines (VM) which provide the resources requested by the clients.
b) *Service Packs:* Each virtual machine consists service packs such as VMl contains a service pack for software; VM2 contains a service pack for software and network resources and so on. Each service pack has a price fixed per sec.
c) *Cloudlets:* The tasks or jobs currently running in the VM are cloudlets. Based on the request of the client, the corresponding resource pack is executed and the service is provided to the client.
d) *Load Balancer:* This component models the load balance policy used by data center's when serving allocation requests. By default the load balancing policy uses a round robin algorithm. This allocates all incoming requests to the available virtual machines in round robin fashion without considering the load existing on each virtual machine.

In the CloudSim, We take three cloudlets and two VM's for the testing this algorithm. VM's contains a package and each package has fixed price.

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Cloudlets	VM's	PACKAGES
C0	VM0	P1
C1	VM1	P2
C2		

C0 and C2 request for P1 and C2 Request for P2.VM0 having P1 and VM1 having P2.
Figure 3 Shows a log file that is generated when a service is given to the client. It contains the details such as the user request currently in execution. The time taken to serve the request is also generated. It also generate the cost of client and service provider.

```
Client Cost : 9980393.43
Provider Cost : 4990196.715
Profit : 4990196.715
============================================================
Time : 1333.3333333333333
Cloudlet id : 0
Vm Id: 0
Package : Package 1
Client Cost : 66666.66666666666
Provider Cost : 33333.33333333333
Profit : 33333.33333333333
============================================================
Time : 78107.47333333333
Cloudlet id : 1
Vm Id: 1
Package : Package 2
Client Cost : 9607219.219999999
Provider Cost : 4803609.609999999
Profit : 4803609.609999999
============================================================
Time : 81141.41
Cloudlet id : 2
Vm Id: 0
Package : Package 1
Client Cost : 4057070.5
Provider Cost : 2028535.25
Profit : 2028535.25
============================================================
```

Figure 3: Log File

Figure 4 Shows the total turn- around time of cloudlets in cost scheduling algorithm and simple algorithm.

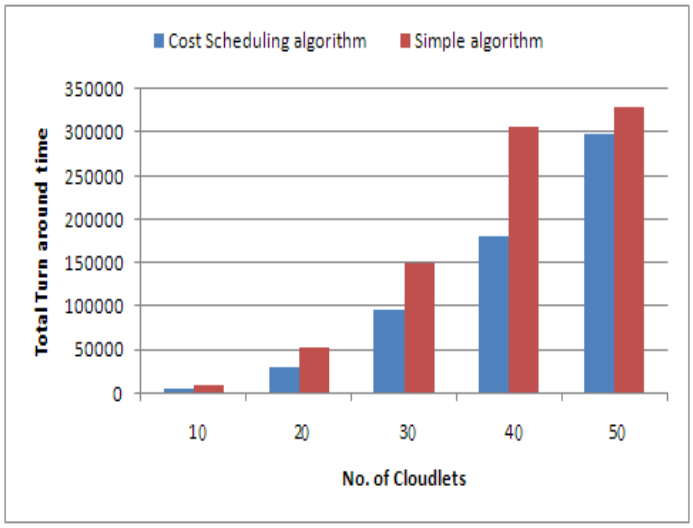

Figure 4: Total turnaround time Vs Cloudlets

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VI. CONCLUSION AND FUTURE WORK

Resource Scheduling is the important tasks in cloud computing environment. The cost scheduling algorithm which helps us to reduce the cost. Cloud resources that have been used are minimal. This algorithm works fine when the VM in the data center are idle. This algorithm does not work fine when all the VM in the data center's are busy and the new requests are in waiting state. This algorithm will not perform well if any fault occurs in VM and If user required two package then user have to process two VM's because each VM consist package so it increases the cost of users and service providers.

In our proposed work, Cloudlets will be grouped according to VM packages and sort the cloudlets according to priority and packages will be grouped in VM . Whenever user will request for two packages then there will be no need to process two VM's because each VM contain group of packages. VM's will be sorted according to processing power. Based on priority cloudlets will be assigned to VM consisting of that packages and cloudlets will be executed in round robin manner. When the user didn't find the required package then our proposed algorithm will replicate the VM and dynamically generate the package.

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