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RANGE WISE BUSY CHECKING ALGORITHM FOR CLOUDLET ALLOCATION AND LOAD BALANCING

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ABSTRACT

In recent years, the information communication technology (ICT) appeared new paradigm of utility computing called cloud computing. The consumer cloud is always important of high performance for cloud computing service and satisfy service agree level (SLA). The allocation of cloudlet(s) to suitable VM(s) is one of the most challenging areas of research in the domain of cloud computing. The Range wise Busy-checking 2-way Balanced (RB2B) Cloudlet allocation algorithm optimizes few basic parameters associated with the performance analysis. Also the modified RB2B improves the load balancing in comparison with the existing RB2B cloudlet allocation algorithms.

KEYWORDS: Cloudlet, Cloudlet allocation, Cloud service provider, VM

1. INTRODUCTION

Cloud computing is the newest trend in the field of computer science and it is said to be the future of modern technology. In cloud computing the word cloud refers as internet, so the meaning of cloud computing is Internet Based Computing. In other words it‟s a kind of server based computing. Cloud computing provide on demand services to the client. The services includes SaaS

(Software as a service) where application software and database access provided to the user pay per use basis, IaaS (infrastructure as a Service) where virtual machine provided to the user using virtualization of physical machine which includes processing power, storage and other resources, PaaS (Platform as a Service) where cloud provider provides a computing platform which includes OS, programming language execution platform and web server.

Cloud computing is popular mostly for its special ability to utilize shared resources

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most efficiently. The allocation of the cloudlets to the suitable resources known as the virtual machines or VMs is an essential requirement in cloud computing environment. In a typical Cloud environment there is a module known as datacenter broker (DCB) which controls the entire datacenter including the cloudlet allocation to VMs. So, like any normal computing performance optimization and improvement of the allocation algorithm is always a possibility. Engineering an efficient cloudlet allocation algorithm is a challenging research area and many such policies have been proposed, analyzed and compared on heterogeneous parallel computing environments. Load balancing is an important issue in cloud computing which affects the performance of the cloud service provider. The cloudlet allocation algorithm RB2B focuses mostly on reducing waiting time and make span, at the same time optimizing VM utilization to a remarkable amount by distributing the number of cloudlets to the VMs in a most uniform way. The algorithm is incorporated in the datacenter broker (DCB) module. The DCB policy is enhanced with this work and termed as advanced datacenter broker (ADCB) module in this study. An extensive simulation is done to evaluate the proposed algorithm using Cloudsim to attest its efficacy in comparison to the other existing allocation policies

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2. CLOUDSIM

The CloudSim framework which is an open source cloud computing environment simulator is developed on GridSim toolkit. The CloudSim supports resource management and application scheduling simulation and implementation of new policies. The CloudSim provides a series of extended classes and methods. It also helps to analyze new cloudlet allocation policies and scheduling criteria at different levels.

The present study aims at utilizing CloudSim 3.0.3 by modifying the datacenter broker algorithm. The Datacenter Broker algorithm plays a key role in cloud service management. Few other important modules of CloudSim 3.0.3 toolkit are given below.

2.1. Cloud Information Service (CIS)

CIS is nothing but database level match-making service. User requests are mapped by CIS to suitable cloud providers. CIS and Datacenter Broker of CloudSim perform resource discovery and information interaction, it is the core of simulated scheduling .

2.2 Data center (DC)

Data center consists of hosts or physical nodes.

2.3. Cloudlet

It is a package of processes or tasks. A cloudlet is sent from the user for processing to the DC. It consists of fields such as cloudlet ID, cloudlet length, arrival time etc. The cloudlet length of cloudlets should be greater than or equal to one.

2.4. Virtual machine (VM)

A virtual machine is an image of shared resource that imitates the characteristics of an individual processing element.

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2.5. Datacenter Broker (DCB)

This class encapsulates the properties of a broker, which is capable of mediating between service providers and users, depending on users' requirements.Service tasks are deployed across clouds by the brokers. New and developing scheduling algorithms and cloudlet allocation policies are implemented in Datacenter Broker method.

2.6. VM scheduler

VM scheduler is an abstract class. It is implemented by a Host component. It represents and specifies the policies whether it is space-shared or time-shared, according to the requirements of allocating cloudlets to VMs.

2.7. VM allocation

It is used as the default VM allocation to the host in CloudSim.

3. RANGE WISE BUSY-CHECKING 2-WAY BALANCED (RB2B)

The RB2B is developed in such a way that it overcomes several drawbacks of the previous works to improve the performance.

3.1. A brief description

This is a three phase algorithm. The phases are a)VM categorization phase b)Two round Busy Checking phase and c)Cloudlet still not allocated phase. The block diagram of the whole process how RB2B works is portrayed in Fig 1.

Initially, certain number of VMs and Cloudlets are created. The VMs are sorted in the increasing order according to the processing speed.

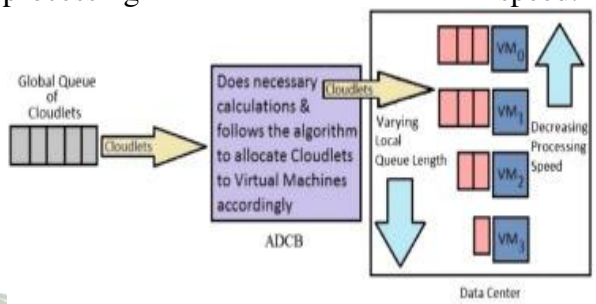

Fig 1.RB2B workflow model

In the first phase, ADCB measures the length (million instructions) of the cloudlet and accordingly chooses a VM (termed as *targeted* VM) following the limits of the VMs. If the VM is available the cloudlet will be allocated to the targeted VM. If the targeted VM is not available the ADCB will search for another VM and check for busy condition. If such suitable VM is available, the cloudlet will be allocated. But if the cloudlet is not allocated even after the two phases then it goes to the third phase of the algorithm. In this third phase the VM with Earliest Finish Time is found and the cloudlet will be queued to the local queue of that VM.

3.2. Phases of RB2B

There are three phases in RB2B. They are described in this section in detail.

3.2.1. VM categorization phase

In this phase, the VMs are categorized following the upper and lower limits of VM.

Assume, the total number of VMs created is '*m*'. Now according to the algorithm ADCB

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will find a suitable VM according to the length of the cloudlet. So, ADCB will initially define a cloudlet length acceptance range for each VM. Suppose C_{min} and C_{max} are the minimum and maximum cloudlet length (In MI). $MIPS_i$ is the processing speed of VM_i. So, the total of the processing speeds of the VMs is calculated according to equation (1).

$$\mathbf{MIPS_{total}= \sum_{i=0}^{n-1}(MIPS_i)} \quad \mathbf{(1)}$$

Now, if the ratio of the difference of maximum and minimum cloudlet length and $MIPS_{Total}$ be x, then the calculation of x will be as per equation (2).

$$\mathbf{x=(C_{max}-C_{min})/MIPS_{Total}} \quad \mathbf{(2)}$$

The range of each VM_m is calculated as per equation (3).

$$\mathbf{Range_i = MIPS_i * x} \quad \mathbf{(3)}$$

The Limit for first VM is calculated as per equation (4) and (5)

$$\mathbf{Lower\ limit=C_{min}} \quad \mathbf{(4)}$$

$$\mathbf{Upper\ limit=C_{min} +Range_0} \quad \mathbf{(5)}$$

The Limits for each VM_m is calculated as per equation (6) and (7)

$$\mathbf{Lowerlimit_i =Range_{i-1} + 1} \quad \mathbf{(6)}$$

$$\mathbf{Upperlimit_i =Range_i} \quad \mathbf{(7)}$$

After the arrival of a cloudlet, the ADCB finds a suitable VM considering the cloudlet's length and the VM chosen in this phase is termed as targeted VM.

3.2.2. Two round busy checking phase

This is the second phase of the algorithm. After finding the targeted VM in the first phase the ADCB checks whether the targeted VM is available or not. If the targeted VM is available then the Cloudlet will be allocated to that VM. Otherwise, ADCB searches for the other VMs following the two rounds:

(i) First round of Busy Checking

If the targeted VM is not the VM with the highest MIPS, then ADCB checks whether the next VM with higher MIPS is busy or not. If this VM is found to be available, the cloudlet is allocated to it. Otherwise, the VM with higher MIPS to the targeted VM is checked for busy condition. This round of checking will continue until either the cloudlet is allocated or the VM with the highest MIPS is checked. This round is illustrated in Fig. 3.

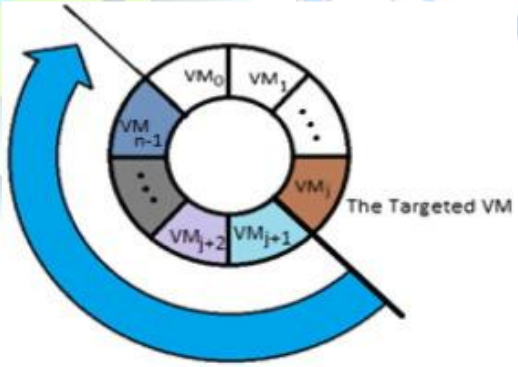

Fig 3. 1st round of Busy Checking.

(ii)Second Round of Busy Checking

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If the cloudlet is still not allocated after the first round, then the second round of checking will commence. At first the VM with the lower MIPS which is next to the targeted VM is checked whether it is suitable or not. If it is suitable then the cloudlet is allocated to it. Otherwise, the next VMs with lower MIPS are checked in a similar manner until the cloudlet is allocated to a suitable VM or the VM with the lowest MIPS is checked. This round is illustrated in Fig. 4.

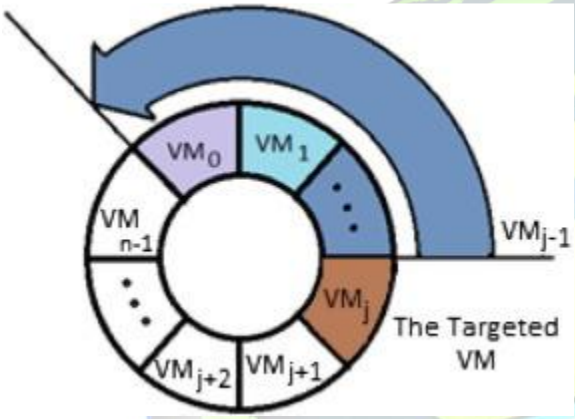

Fig 4. 2nd round of busy checking.

3.2.3. Cloudlet-still-not-allocated phase (CSNA)

It is the last phase of RB2B. After the first two phases if the Cloudlet is allocated to the VM then the ADCB will move to the next Cloudlet in the global queue. But if the arriving cloudlet is still not allocated even after the first two phases, then the ADCB will search for the VM with earliest finish time for that cloudlet.

In Fig. 5, arriving cloudlet C_1 arrives and ADCB finds both of the VMs busy. Now it is clear from the Fig. that VM_1 becomes free at 3 and VM_2 becomes free at 5. So the VM_1 becomes free earlier than VM_2 but the finish time of VM_2 for C_1 is lesser than that of the VM_1. Hence, C_1 is allocated to VM_2. If two or more VMs show the same amount of finish time for a cloudlet, then the VM which becomes free earlier is chosen for that cloudlet.

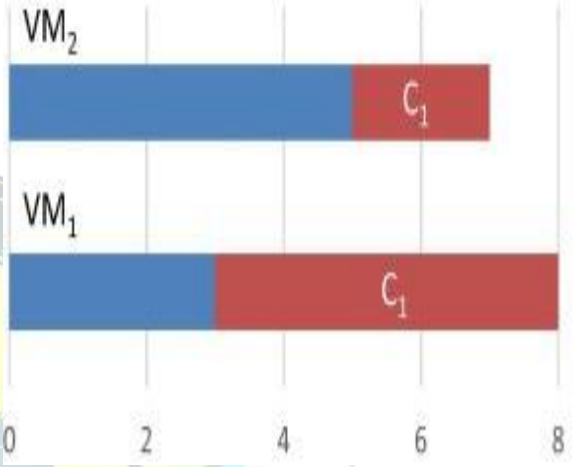

Fig 5. Cloudlets in CSNA phase

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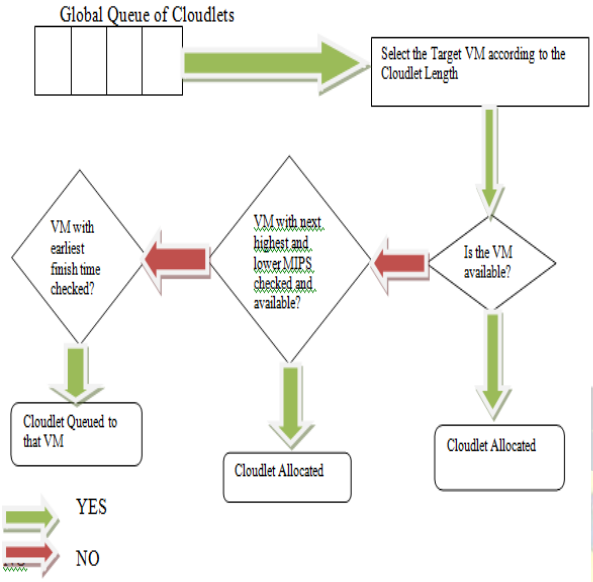
3.3. FLOW CHART OF RB2B



In Range wise Busy Checking 2-Way balanced Algorithm Load Balancing is a major drawback. In order to achieve Load Balancing we consider the length of Cloudlet instead of the number of Cloudlets allocated to each VM. This is done by finding the maximum Cloudlet length among the Cloudlets allocated and assigning that length as the range for each VM. The Cloudlets are allocated to the VM until the range is reached. Thus each VM will perform equal amount of tasks and hence Load Balancing is performed.

3.4. ALGORITHM OF MODIFIED RB2B:

STEP 1: The 'm' number of VMs and 'n' number of cloudlets are created by random generation for Cloudlet Length and VM processing speed.

STEP 2: Find the total processing speed ($MIPS_{total}$) by adding the processing speed of all the VMs.

STEP 3: Find the maximum and minimum Cloudlet length and subtract it and store in the variable 'x'.

STEP 4: Find the range for each VM by multiplying the processing speed with 'x' and divide it by $MIPS_{total}$.

STEP 5: Find the Upper and Lower limit of each VM by adding the range. Find the target VM for each Cloudlet according to the Upper and Lower limits.

STEP 6: Check whether the targeted VM is available or busy. If it is available allocate the Cloudlet to the VM.

STEP 7: If it is busy find the next VM with Largest processing speed and check whether that VM is available or busy. If it is available allocate the Cloudlet to the VM. Else check the next VM until the VM with maximum processing speed is reached.

STEP 8: If the Cloudlets are not allocated then check the VM with Lower processing speed next to the targeted VM and check whether that VM is available or busy. If it is available allocate the Cloudlet to the VM. Else check the next VM until the VM with minimum processing speed is reached.

STEP 9: Find the maximum Cloudlet length among the Cloudlets allocated and assign that length as the range for each VM. The Cloudlets are allocated to the VM until the range is reached.

STEP 10: If the Cloudlets are still not allocated then find the VM with earliest finish time and assign the Cloudlet to the local queue of that VM.

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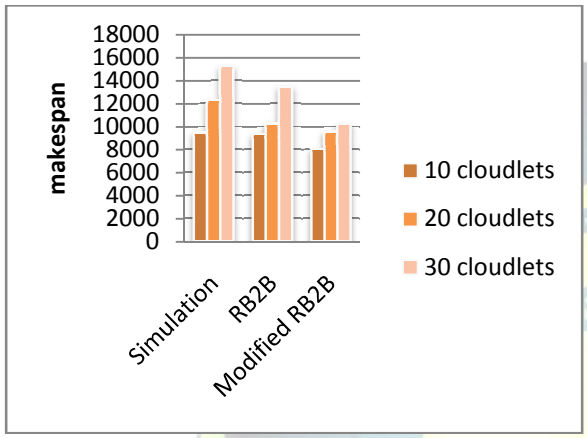
4. RESULTS AND DISCUSSION

In order to obtain results of the proposed algorithm the simulation was done using CloudSim 3.0.2 Simulator. In Our simulation scenario, the proposed algorithm is compared to the existing algorithm, and the drawback of load balancing is rectified.



Average Make span comparison

5. CONCLUSION

Cloud computing is a distributed computing which mainly focuses on providing services to the customers and it provides computational as well as storage resources to users. Cloudlet allocation provides a key role in good service delivery.
In order to improve the load balancing Modified Range-Wise Busy Checking 2-Way Balanced allocation algorithm is used and load balancing is achieved.

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