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Improved Implementation of Hybrid Approach in Cloud Environment

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***Abstract*—** Cloud computing is a technological advancement which is based on the concept of dynamic resources provisioning using internet. Web 2.0 technologies play a central role. Hybrid approach to load balancing will provides better results in providing the improvement in the load balancing. Combination of Round robin with Throttled Algorithm in a combination RTH is observed with some disadvantages such as updating the Index table leads to an overhead and sometimes it is causing delay in providing response to arrived requests. It is found a slight improvement in combination with RTH and ESCE in hybrid approach manner to called RTEH.RTEH Algorithm also shown drawback as it is still getting overhead in updating the index table. Then Artificial Bee Colony Optimization technique is combined with RTEH and obtained RTEAH Algorithm has shown betterment in case of some load balancing parameters such as response time, Execution time etc.

***Keywords*—** Cloud computing, Task scheduling, CloudSim, Round robin, Equally spread current execution, Throttled, Artificial bee colony

I. INTRODUCTION

Cloud computing working mechanism differs from other technologies. It is ubiquitous which means being present everywhere in all the time for simultaneously accessible It uses virtualization technology which allows to share single resource among multiple users [2]. Virtual machine is a computer file also called 'Image' which behaves like an actual computer. Virtual machine creates a computer inside a computer. Each virtual machine provides its own virtual hardware, such as CPUs, Memory, Hard Drives, Network Interface etc., after providing the virtual hardware then it is mapped to the real physical hardware systems, virtual machines are platform independent, uses Common Language Runtime, Ex: IBM CP/CMS [5].

II. LOAD BALANCING

The load balancer distributes the incoming application traffic across multiple targets, in multiple availability zones. This increases the availability of our application. Advantages of load balancing are (i). Reduces the waiting the time, (ii). Minimizes the response time, (iii). Maximizes the through put, (iv). Improves reliability, (v). Improves stability, (vi). Log starvation is avoided for smaller jobs, (vii). Overall system performance is enhanced. it is done because (i) To avoid system crash (ii) For the smooth running of computation (iii) To have Quality of Service and (iv) To run the program in less time [10].

The interested parameters in Load balancing in cloud computing are (i)Response time which is the time taken for a system to react to a given event (ii) Execution time is the time spent by the system for the execution of task,(iii) Turnaround time is the time taken for a program to provide an output,(iv)Processing time is time taken to process (v)Throughput is the maximum rate of something which can be processed , Network delay is the time taken for a bit of data to travel from one node to another node.

III. INTERNAL WORKING MECHANISM OF A HYBRID ALGORITHM

Before a user [11] sends a request to the load balancer, it resolves the load balancer's domain name using a domain name server (DNS). DNS server returns one or more IP (Internet Protocol) Addresses to the client. With network load balancers, Load balancing creates a network interface for each available virtual machines list which are either busy/idle. Each load balancer node in this virtual machine list uses this network interface to get a static IP Address. It can be optionally associate one IP Address with each network interface when it creates the load balancer. As Traffic to the application changes overtime, load balancing scales the load balancer and updates the DNS entry. Load balancer node requests the node. Load balancer node selects a virtual machine which can handle the request. Now the load balancer node sends the request to the target using its private IP Address. When a load balancer accepts incoming traffic from client and routes the requests to its virtual machine pool. Load balancer also checks whether the virtual machine

is either idle/busy and ensures that it routs the traffic only to the virtual machines which are capable to handle.

IV. CLOUD BASED SCHEDULING ALGORITHMS

Efficiency of the algorithms could be simulated using toolkit bundle of CloudSim. Algorithms could be tested in view of scheduling concern. The results of the experiments can be investigated.

V. EQUALLY SPREAD CURRENT EXECUTION LOAD BALANCING ALGORITHM

In spread spectrum technique load balancer makes effort to preserve equal load to all the virtual machines connected with the data centre. Equally Spread Current Execution Load Balancing Algorithm characteristics as follows:

1. It is Dynamic Algorithm
2. It is virtual machine Load Balancing Algorithm
3. It is based on spread spectrum technique
4. It Loads the scheduling tasks equally i.e., equally spreading
5. Load balancer monitors the scheduled jobs. ESC load balancer puts all the tasks in the job pool and assigns them to the virtual machine. As the load balancer monitors the Scheduled Jobs, balancer keeps track of job's which are in the queue frequently. For new tasks assigns the pool of virtual machine. i.e., pool of jobs assigned to pool of virtual machines this algorithm makes the server to be loaded evenly equally as given below in fig.1.

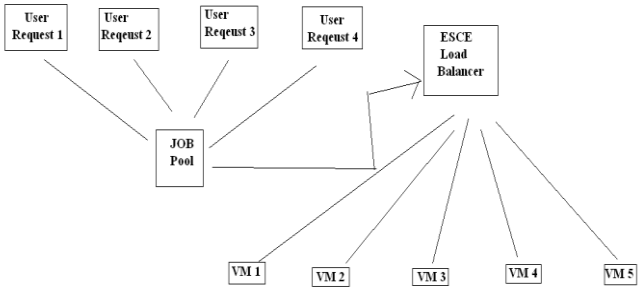


Fig.1. Equally spread current execution algorithm working mechanism

Equally spread current execution algorithm simulation result

Response time	Execution time	Turnaround time	Processing time	Throughput	Network delay
300.36	0.03207	0.26	0.26	3.312	13.96

Table 1. Equally spread current execution algorithm simulation result

Advantages of Equally Spread Current Execution Algorithm: This algorithm balances the load properly up to some extent.

Disadvantages of New RTH Algorithm: For updating the Index table leads to an overhead and may cause to the delay in providing response to arrived requests. It could be find a slight improvement in comparison with RTH and ESCE

	RTH Algorithm	ESCE Algorithm
Response Time	0.5006 (in Nano Seconds)	0.5006
Execution time	0.031	0.03207
Turnaround time	0.26	0.26
Processing Time	0.26	0.26
Throughput	3.311	3.312
Network Delay	13.89	13.96

Table 2: RTH and ESCE comparison

Search for a new Algorithm for the betterment in RTH Algorithm: The main drawback of RTH algorithm shows better performance only when Data Center has the virtual machines of all are of the same configuration. Combination of RTH and Equally Spread Current Execution Algorithm: In order to improve the problem raised by RTH Algorithm, let it be considered "Equally Spread Current Execution Load Balancing Algorithm" which is based on Spread Spectrum Concept to combine with RTH Algorithm and call it as RTEH Algorithm.

Round Robin – Throttled –Equally Spread Current Execution Hybrid Algorithm (RTEH) Proposal:

It is a clear intension is to make a flexible algorithm for the best usage. Therefore it can be added RTH Algorithm with Equally spread current execution algorithm such as all tasks in the job pool assigns to the virtual machine as the load balancer monitors the scheduled jobs, balancer keeps tracks of jobs which are in the queue frequently for new tasks assigns from the pool of virtual machine. i.e., pool of tasks assigned to a pool of virtual machines. This characteristic is taken from equally spread current execution algorithm.

As since the defect found in the RTH as it requires all virtual machines to be had in the same configuration, and for the best improvement for load balancing, it is needed to distribute the load equally to all the virtual machines which are connected to the data center it can be choose equally spread current execution algorithm which is based on spread spectrum technique. But it is observed that there is considerably a delay in providing response to the arrived requests. But distributing the load equally in providing response to the arrived requests. But distributing the load equally is a good strategy for implementation and having this in the hybrid algorithm it can have such as the algorithm can

be constructed using a combination of RTHEH Algorithm. In order to avoid the delay in response time and for the heterogeneous or different types hardware configurations of virtual machines it can be combined the RTH with equally spread current execution algorithm and call it as RTEH algorithm. It is observed that this algorithm also reduces the context Switch and reduces the turnaround time and increases the throughput.

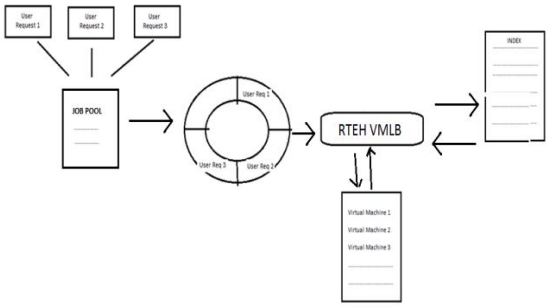


Fig. 2. RTEHVMLB Algorithm Working Mechanism

RTEH Algorithm PSEUDO Code:
Inputs: User bases- UB1, UB2, UB3, UB4, UB5, UB6 (These are Cloudlet User Requests), Virtual Machines- VM1, VM2, VM3, VM4, VM5, VM6 within the data center.
Step: 1: RTEH Load Balancer (RTEH LB) maintains an index table of available virtual machines and their status.
Step: 2: When a Data Center controller receives the new request, they are sent to a "Pool of Jobs", and the Data Center controller Queries the RTEHLB for the next allocation.
Step: 3: From the available jobs the requests are randomly selected and assigned to RTEHLB, RTEHLB on the other hand has the index table.
Step: 4: RTEHLB parses the allocation table from top until the 1st available virtual machine is found or the table is parsed completely.
If found:
(i)RTEH VMLB returns the VMID to the Data Center Controller
(ii)Data Center Controller sends the request to the virtual machine Identified by that ID
(iii) Data Center Controller notifies the RTEHVMLB of the new allocation
(iv) RTEHVMLB updates the allocation table as per the requirements.
Step: 5: When the virtual machine finishes the processing the request and the Data Center controller obtains the response cloudlet, it informs the RTEHVMLB of virtual machine for the de-allocation.
Step: 6: Data Center controller checks if there are any requests are in waiting, if there are some are waiting. It carries on from step:5
Step: 9: Continue from Step:2.

RTEH Algorithm observational results:

Response Time	Execution Time	Turn-around Time	Processing Time	Throughput	Network Delay
295.37	0.03103	0.26	0.26	3.312	12.86

Table 3. RTEH Algorithm observational results

Advantages of New RTEH Algorithm: It is found that New RTEH algorithm has considerably increased make span.
Disadvantages of New RTEH Algorithm: It is experimentally that existing problem in updating the index table and getting overhead.
Search for a new Algorithm for the betterment in RTEH Algorithm: The main drawback of RTEH Algorithm is updating in the table is getting overhead. In order to improve this, let it be considered to improve this RTEH Algorithm.

VI. ARTIFICIAL BEE COLONY OPTIMIZATION

Karaboga, proposed a foraging behaviour of honey bee swarm in 2005. Artificial Bee Colony Optimization technique was inspired by the above mentioned behaviour of bee swarm. It is motivated by the intelligent foraging behaviour of honey bees and is the simulation of the minimalistic foraging model of honey bee in search process for solving real time parameter, non-convex, and non-smooth optimization problem. In this algorithm, a colony would consists of three types of artificial bees including employed, onlooker and scout bees.

Observational results on the execution of ABC algorithm

Response Time	Execution Time	Turn-around Time	Processing Time	Throughput	Network Delay
300.36	0.03207	0.26	0.26	3.312	13.96

Table 4. Load balancing in artificial bee colony optimization algorithm

Disadvantages of ABC Algorithm
It is experimentally seen that existing problem
1. It is slow to obtain accurate solution
2. It has the possibility of losing relevant information on the behavior of the function to be optimized
3. It requires new fitness tasks on the new algorithm parameters to improve performance
4. It lacks of use of secondary information about the problem

Any Modified load balancing algorithm gives some modifications to the existing algorithm. This makes the user to get the flexibility in getting the services from the cloud provider. As it is known that while providing resources as services it is possible to have a number of requests at the same time and due to some requestor need to remain in the queue though they have possibility to send requests to the

other provider. That means it cannot withdraw the request in middle as a result sometimes the requests may get over crowded. Thus to overcome such situations it can be modified the existing algorithm and make it available to the user.

VII. PROPOSING A NEW ALGORITHM

It is a main aim to provide a comparative study of the performance of efficient load balancers in cloud data center, and from there selecting an optimal load balancer. To do this below steps are needed to be done.

Step-1: It must be looked in to different techniques by comparing various load balancers performance. It can be looked in to some parameters such as processing cost, response time etc, in order to evaluate those load balancers.

Step-2: It must select a load balancer algorithm or propose which can use minimum resources and within a short processing time. Hybrid approach to Load balancing can be made either of two ways:

(i) Software Approach

(ii) Hardware Approach. In Software Approach it shall be interested in algorithmic approach. It shall look in to the scheduling algorithm for load balancing.

Load balancing is categorized in to 4 basic types

(i)Centralized Load balancing algorithm

(ii) Distributed Load balancing algorithm

(iii) Hierarchical Load balancing algorithm

(iv) Workflow Dependent Load balancing algorithm.

It shall be interested in deriving a hybrid algorithm from the available scheduling algorithms. Let it be considered RTEH and Artificial Bee colony Optimization algorithm.

VIII. RTEAH HYBRID ALGORITHM

1. Data Center controller receives the new user cloudlet request randomly from round robin algorithm.

2. RTEAH Load balancer keeps a list of virtual machines and their status whether they are busy or idling from the index table

3. All tasks in the job pool assigns the virtual machine as the load balancer monitors the scheduled jobs, balancer keeps track of jobs which are in the queue frequently for new tasks assigns the pool of virtual machine pool of jobs assigns to a pool of virtual machines

4.Calculate the load of the user cloudlet request and calculate the capacity of virtual machines

A new hybrid approach based load balancing algorithm can be had as RTEAH Algorithm. Here H is Hybrid.

VIII. RESEARCH METHODOLOGY

Research methodology is empirical. Primary data is taken from some of the cloud providers, rackspace, iweb, ispace and qtcloud services are a few to mention here.

Pseudo code

Begin

Step: 1: Hybrid Load Balancer maintains an Index of virtual machines and their status whether The virtual machines are busy or idling.

At the beginning none of the Virtual Machines are allocated to any of the user requests..

Step: 2: The Data Center controller receives the user requests i.e., Urs(Basically they are Cloudlets) Let Ur enter the Data Center controller receives the user requests/Cloudlets. Calculate the load of the user request. Calculate the load and the capacity of a Virtual Machine. Let all Virtual Machines are checked in circular way The user requests are allocated to Virtual Machines on the basis of their statuses which are known from the Virtual Machine Queue: if the status is available then cloudlet is allocated. The Hybrid Load Balancer will allocate the time Quantum for user request execution

Step: 3: After the execution of cloudlets the Virtual Machines are de-allocated by the Hybrid Load balancer.

Do

Find the next available Virtual Machine

Update and Load the Capacity of Virtual Machine

Calculate Virtual Machine Future resource and value of each Machine. Choose the low loaded Machine and migrate the task from overloaded machine

If Ur1<=VM3

Assign the Ur1 to VM3

Assign the Request Queue/Pool to the VM Queue While

Step: 4: The Data Center controller checks for new/pending/waiting requests in Queue

Count the active load on Virtual Machine

Update the Load and the Capacity of Virtual Machine Submit the ID of Those Virtual Machine which are consisting of Minimum Load If Ur > VM1

Swap the Ur1 to VM2 If Ur1> VM2

Swap the Ur1 to VM3

……., …….

Step: 5: Continue from Step-2

Termination Criterion is not violated

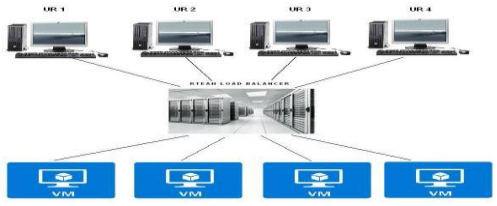
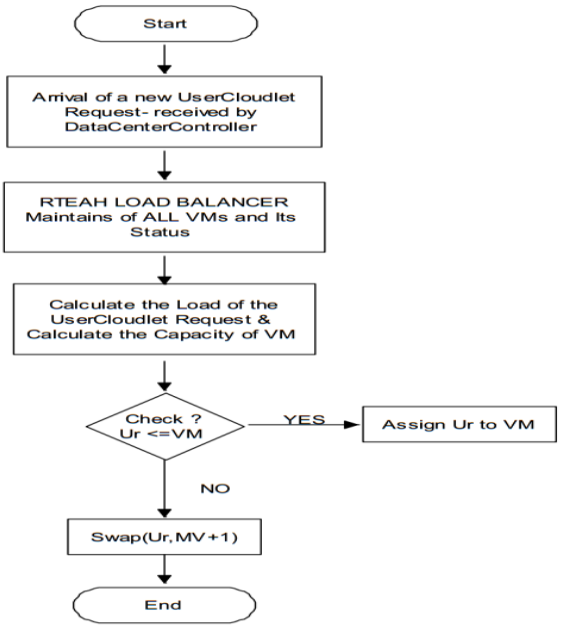


Figure: 3: RTEAH Algorithm Working Mechanism

XI. FLOWCHART



Flowchart.1. RTEAHVMLB Algorithm Flowchart

XII. EXPERIMENTAL SETUP

Virtual Machine Load balancing algorithms can be implemented using the following soft wares and tools. Operating system: Windows XP or Windows 7., IDE: Net beans 8.1/Eclipse-Kepler, Toolkit: JDK 1.8 and Cloud Analyst tool.

Algorithms are implemented for IaaS model in a simulated cloud environment.

Cloud Analyst is an extension to CloudSim oriented simulator used for modelling and simulation of real cloud environment. Some of the Key elements are as follows:

(ii) Region(R) : World is split in to six regions representing six continents viz Asia, Australia, Africa, North America, South America, and Europe.

User base and Data Center which are very essential components of cloud analyst will reside in these regions.

(iii) User base(UB):A group of users are modelled using this component which is taken as a single unit. Traffic generation is the major responsibility of this component.

(iv) Data center controller (DCC): is the most important single cloud sim maps a single DCC. Various activities such as cloudlet request routing, creating and destruction of virtual machines are managed using DCC.

(v) Virtual machine load balancer (VMLB): is used to decide the assignment of cloudlets on virtual machines.

(vi) Cloud application service broker (CASB): Traffic routing is managed between user bases and data centres using this element.

For algorithm simulation: Six user bases are there: they are UB1,UB2,UB3,UB4,UB5,UB6 can be increased or decreased ,Four data centres are there: They are D1,D2,D3,D4 can be increased or decreased, Six regions are there: R0,R1,R2,R3,R4,R5,R6(Regions are fixed . Each data center is constructed with 15 Physical machines each have the following configuration. 8086 architecture, Linux operating system, Xen virtual machine manager, 204800 RAM(MB), 100TB Storage space,10,0000 Bandwidth, 4 Processors, 1000 MIPS Time shared virtual machines Scheduling Policy. Each physical machine is consolidated with 10 virtual machines. Each virtual machine is configured as 1000 MB Image size, 512 MB Memory, 1000 MB Bandwidth.

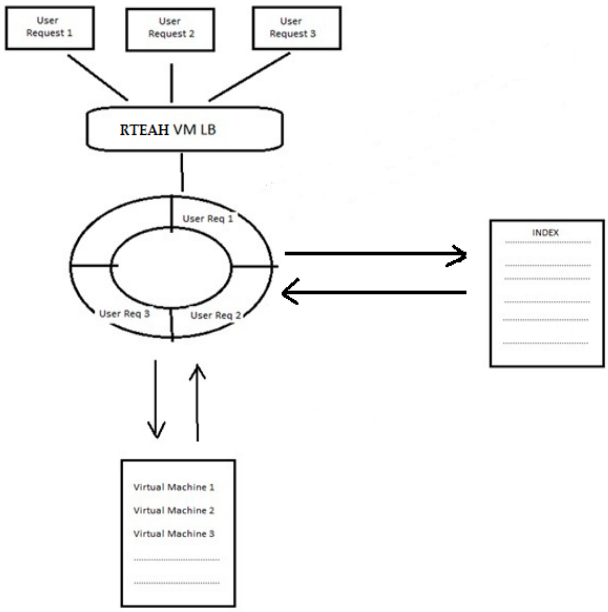


Fig.3. RTEAH algorithm working mechanism

RTEAH Algorithm Simulation Result

Resp. time	Exe. time	Turnaround time	Proc. time	Throughput	Net. delay
292.47	0.03004	0.24	0.23	3.309	11.44

Table 5.Load balancing in RTEAH Algorithm

RTEAH Algorithm in comparison with other Algorithms

	Round Robin	Throttled Algorithm	RTH Algorithm	RTEH Algorithm	RTEAH Algorithm

	Algorithm				
Response time	300.41	300.41	300.36	295.37	292.47
Execution time	0.03448	0.03571	0.031	0.03103	0.03004
Turnaround time	0.29	0.28	0.26	0.26	0.24
Processing time	0.29	0.28	0.26	0.26	0.23
Throughput	3.31214	3.31613	3.311	3.312	3.309
Network delay	13.88	13.68	13.73	13.64	11.44

Table 6.RTEAH Algorithm in comparison with other algorithms

RTEAH Algorithm in comparison with other algorithms Graph

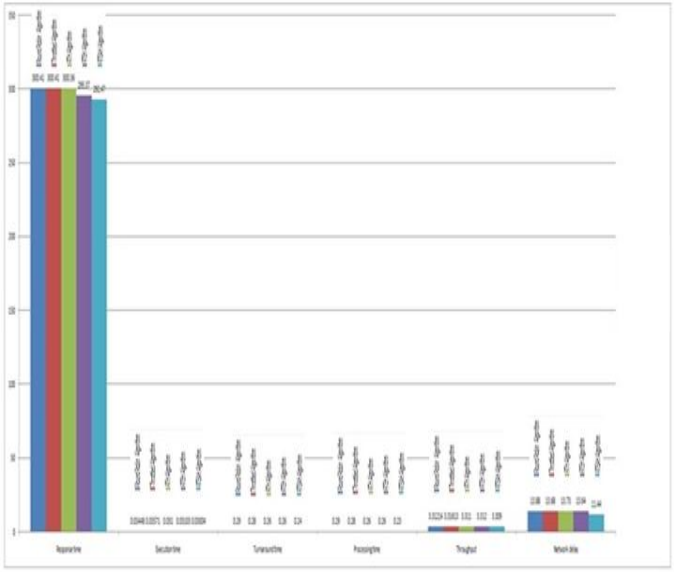


Fig.4. Load balancing in RTEAH Algorithm in comparison with other algorithms Graph

RTEAH Algorithm Observations

1. It is observed as following
2. **Case: 1**. If a Simple Web Application Hosted on a Single Data Center Response time could be expected to rise much higher.
3. **Case: 2**.When a Web Application Hosted on Multiple Data Centers around the World
4. **Case: 3** If there are two Data Centers with 25 VMs in each, then the average response time reduced (This is Overloaded VMs case)
5. **Case: 4.** If there are two Data Centers with 50 VMs in each, then the average response time is improved
6. **Case: 5**. If there are two data centers with 50 Virtual Machines each, and in case they are sharing the load during the peak hours, in terms of region wise change is not observed but the data center loading patterns changes are observed.
7. **Case: 6**.On applying throttled algorithm to the processing of requests Data center loading patterns changed
8. **Case: 7**.A web application hosted on 3 Data centers with 50 Virtual Machines each Overall response time is improved
9. **Case: 8**.A web application hosted on 3 Data Centers with 75, 50, and 25 Virtual Machines in each, overall response time considerably reduces.

Results from the observations

- Service quality can be increased by the application of load balancing application of load balancing at the application level and also at virtual machine level with data ceneter
- Any improvement in load balancing algorithms employment must be effective to meet the peak demand.

Conclusion: RTEAH Load balancer keeps a list of virtual machines and their status whether they are busy or idling in the form of index table, all tasks in the job pool assigns the virtual machine as the load balancer monitors the scheduled jobs, balancer keeps track of jobs which are in the queue frequently for new tasks assigns the pool of virtual machines pool of jobs assigns to a pool of virtual machines, calculate the load of the user cloudlet request and calculate the capacity of virtual machines. The New RTEAH algorithm has shown betterment in case our cloud computing load balancing parameters in terms of response time, Execution time, Turnaround time, Processing time, Throughput, Network delay. Therefore RTEAH is highly considerable.

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