Load Balancing of Tasks in Cloud Computing Environment Based on Priority Algorithm

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ABSTRACT: Cloud computing is a rising technology which is responsible for supplying of computing resources on the basis of demand, as and when needed. Cloud provides many facilities due to its vast resources such as sharing resources for different purposes. Cloud computing faces many challenges in respect of performance and efficiency. To increase the cloud computing environment's efficiency, Virtual Machines (VM) has been employed for resource provisioning. In this paper, we proposed an algorithm that performs load distribution of workloads among different VM based on priority. This algorithm is proposed in the aim of load balancing of different nodes by considering maximum throughput with minimum execution time. To achieve that, the VM are sorted according to their processing powers and job requests are assigned to VM based on their instruction numbers and priorities. The proposed algorithm is experimented using CloudSim simulator and the results demonstrated that the performance of the algorithm is better than other conventional algorithms.

KEYWORDS: cloud computing, load balancing, round robin algorithm, turnaround time, waiting time, context switch.

I.   INTRODUCTION

Cloud Computing, internet-based computing service, provides the different types of cloud services such as servers, storage and application to the resources of the organizations. It plays an important role in IT industries. It has showed the way, how to develop software by providing the flexibility of resources which have been shared between the developers. Cloud computing is not only can provide the services to many users at the same time and also the resources have been reallocated as per user demand. It affords the facility to users that users can access their data from any place in the world.   Cloud Computing provides an economic business model that shows how to manage IT resources in various ways [1].In cloud computing environment, Load Balancing is the most important task. Load balancing is the mechanism of distributing of resources in that a way that no overloading has been occurred at any resource and optimal utilization has been performed [2].Every resource works more efficiently which minimizes the response time. The Load Balancer should ensure under and over loading of any resource [3]. In cloud computing environment, it is not very easy to maintain all constrains such as security, reliability and throughput. There are few components which need more attention, Virtual Machine (V.M.) is one of them [4]. Virtual Machine (V.M) is the software platform instate of a physical machine where services are executed like physical machine. It works very efficiently and work like a real machine in which no straight connection to any real hardware has implemented.

Datacenters (DCC) keeps, organizes, circulates, saves and secures the data of an organization. So that Infrastructure level Services has been provided to the Users. Simply it is the platform where the IT components are housed. It is the main part of a cloud, is called brain and the platform where the most critical services execute. Here server has been considered as the part of Data Centre .The Load Balancer manages and allocates load to different virtual machines so

that no nodes get heavily loaded or lightly loaded. The load balancing has to be performed properly since any one of the nodes is failed that can lead to loss or unavailability of data [8][1].

Depend on implementation method; load balancing algorithm is 2 types [5]. Static Load Balancing Algorithm is current state of the system that don't play any role on load balancer's decision. Load balancer takes the decision that in which virtual machine the service will be allocated and executed Whereas dynamic load Balancing algorithm depends on the current situation of the machine. The load balancer checks the current load of each available virtual machine then allocates service at suitable and proper virtual machine. In any load balancing algorithm, the load balancer must try to fulfill the following properties like Maximum number of context switches, throughput, CPU utilization, minimum turnaround time, response time and waiting time.

The rest part of the paper is arranged as follows. Section II gives a rough overview of related work. Section III discusses about the new proposed dynamic time quantum priority-based algorithm has been proposed which is suitable for load balancing in cloud computing environment. Section IV experimental results are shown. Finally, in section V the conclusion is discussed.

II.   RELATED WORK

The load balancer uses the concept of time slices in basic round robin algorithm. In this method, the execution time is distributed into multiple time slices and each node gets a particular time interval like the concept of time scheduling. Within given time quantum each service request is served by the processor. After completion of each time slice, the next user can request and it comes for processing. If the client's service request completes its execution within assigned time quantum or time slice then user would not wait for next round otherwise user has to wait for next round. The basic and primary advantage of this algorithm is that the load balancer allocates the equal time for every service request which ensure fairness.

been defined by sum of maximum burst time and minimum burst time which is divided by 2.In FairRR[7] algorithm they have used the bust time(BT) to calculate the dynamic time quantum(TQ) for every

process which is in ready queue. First, they choose minimum bust time from all the processes and then allocate dynamic TQ to each process where TQ is min BT.

In Priority Based Round Robin algorithm [6] and Intelligent

Time Slice(ITS) has been estimated and allocated the different processing time to each service according to their assigning priority basis. All above methods focus on different measuring parameters of this algorithm. The following parameters are

A. Burst Time (BT)

BT is actually time that is required to complete execution of particular service request.

B. Time Quantum (TQ)

TQ is the given time period for a service to allow to access a VM.

III. IMPLEMENTATION

CLOUDSIM SOFTWARE

- CloudSim is a simulation tool that allows Cloud developers to test performance of their provisioning policies in a repeatable and controllable environment free of cost. It helps
- to tune the bottlenecks before real-world deployment. It is a simulator; hence it doesn't run any actual software. It can be defined as "running a model of an environment in a model of hardware" and technology specific details are abstracted.

- CloudSim is It is basically a Library for Simulation of Cloud Computing Scenarios. It has some features such as it support for modeling and simulation of large scale Cloud Computing infrastructure, including data centers on a single physical computing node. It provides basic classes for describing data centers, virtual machines applications, users, computational resources, and Policies.

- It also supports evaluation of Green IT policies. User can use it as building blocks for simulated Cloud environment and can add new policies for scheduling, load balancing, and new scenarios. It is flexible enough to be used as a library that allows you to write a desired scenario by writing a Java program

- The simulation and analysis of the performance of the three load balancing algorithms are performed using the "Cloud Analyst" tool [5]. It allows the user to run multiple simulations with small parameter changes, and also allows you to customize the location of the users who create the application and the location of the data centers [6]. Let's indicate the terminology of the emulator (Fig. 4):

    o Region: in Cloud Analyst, the world is divided into 6 regions that coincide with the 6 major continents in the world;

    o User Base: User Base is considered as a single unit, and is used to generate traffic;

    o Data Processing Center: brokerage services determine which center should accept and process the request that comes from each user database;

    o VmLoadBalancer: it is responsible for distributing the load to the available data center. VmLoadBalancer distributes the load in the data center based on the load balancing policy.
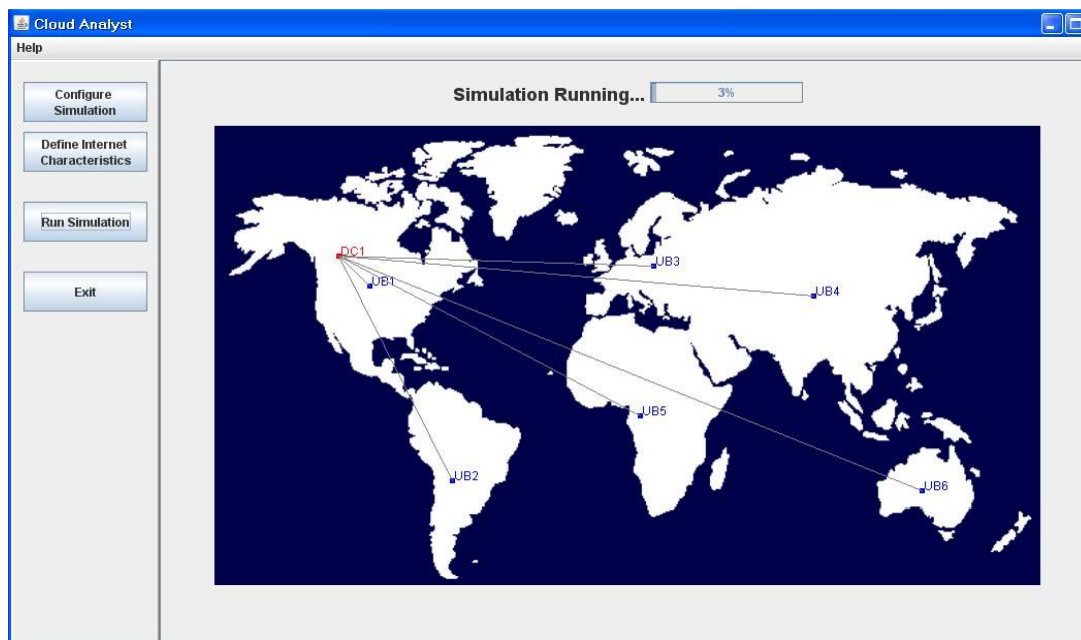

Fig. 4. Cloud Analyst Simulator.

In the modeling process, CloudSim 4.0 software was used.

Data Center Architecture:

The data center is home to the computational power, storage, and applications necessary to support an enterprise business. The data center infrastructure is central to the IT architecture, from which all content is sourced or passes through. Proper planning of the data center infrastructure design is critical, and performance, resiliency, and scalability need to be carefully considered.

Region Division:

The whole earth is divided into five regions to match with the classification of cloud analyzer. Region divisions and the countries within these regions are as follows:[5]

S.No.	Region	Countries
1	R0	USA
2	R1	Countries of North America
3	R2	Countries of European union
4	R3	Countries of Asia like china, India
5	R4	Country from Africa
6	R5	Australia

Here the simulation and performance analysis will be done by using the cloud analyst tool, as depicted in Figure 5.1.
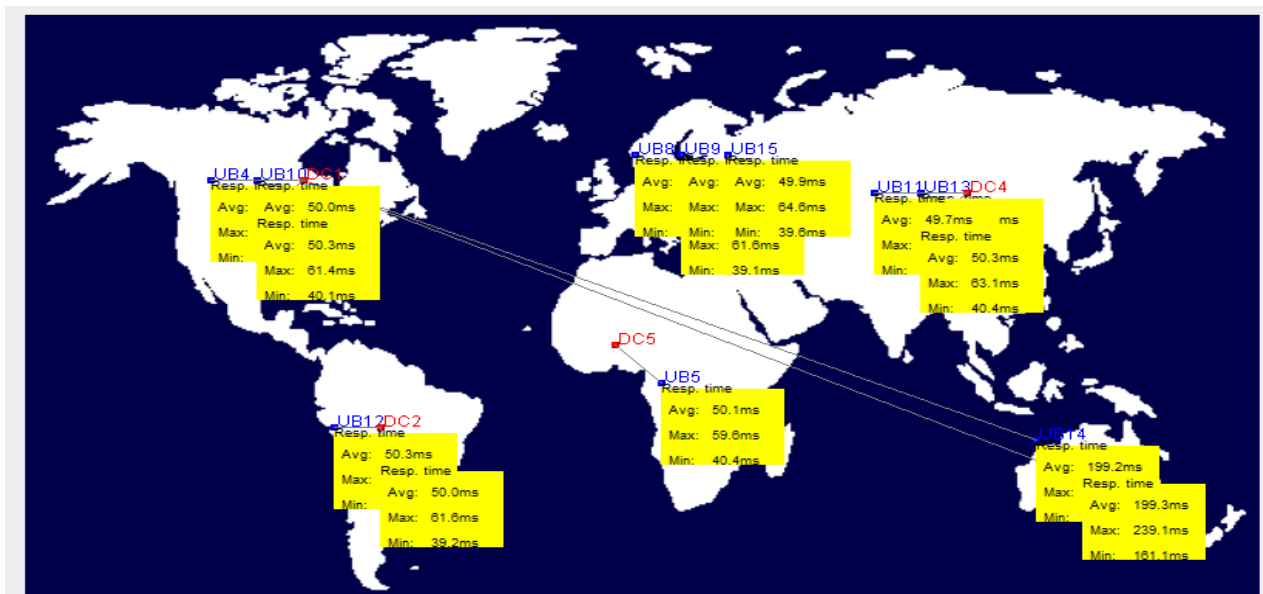

Fig. 5.2: The simulation and performance analysis diagram by using the cloud analyst tool

IV. DATA CENTER NETWORK DESIGN

The Design and simulation for performance analysis will be done by using the OPNET simulation software, as shown in Figure 5.2 bellow.
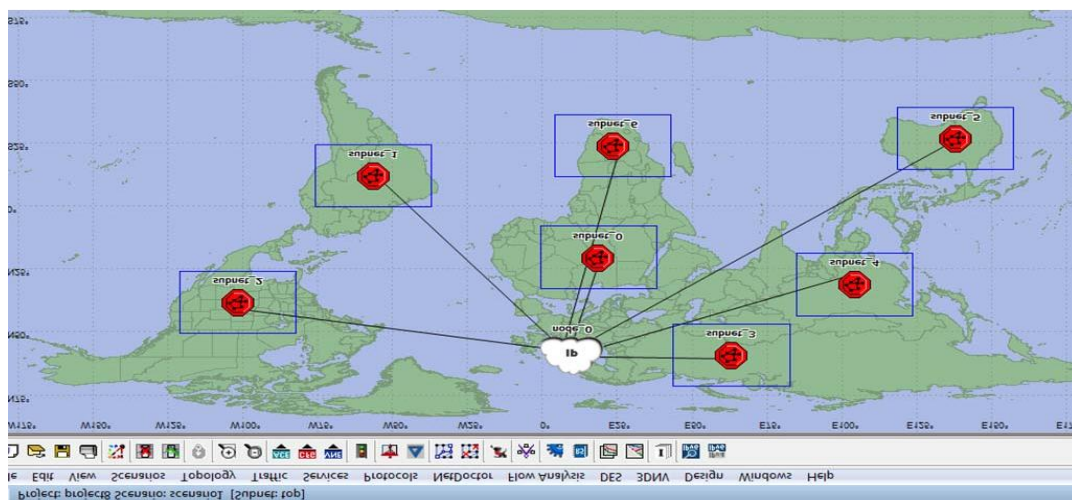

Fig. 5.3: The simulation, design and analysis by using

OPNET

Fig. 5.4 illustrate the design of data-centers subnets, it show that each subnet include storage devices, server, routers and workstations. There are five subnets each of them are about data-center and they connected together by wire line. Each region contains one data-center.
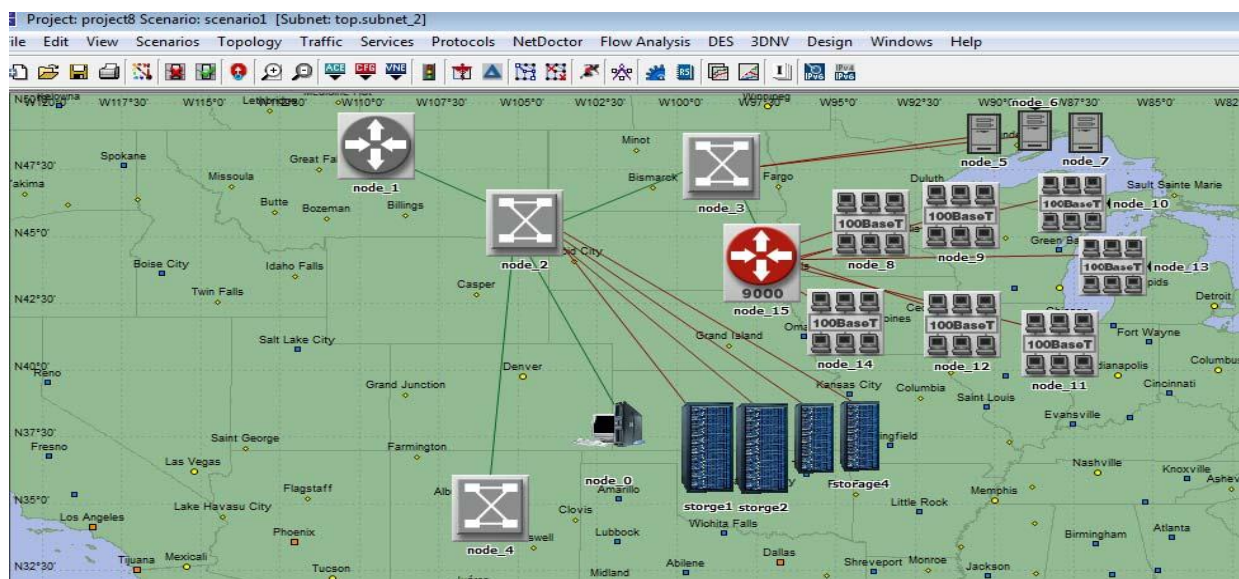

Fig. 5.4: The simulation and design of datacenter (subnet)

by using OPNET Data Center Configuration Parameter: Total 05 data center will be considered for the simulation environment. Architecture of each data centre is given in table (2)

TABLE 3.1 Initial conditions

VM	Core units	Hours
VM1	2	3
VM2	1	1
VM3	6	6
VM4	3	2
VM5	3	5
VM6	2	2

Here we define VM, VM core units and time. Total capacity of physical machine is 9 unit. Show the matrix, it is initial stage, If VM complete before 3.5 hours than VM is short life job otherwise it is long life job.

In second stage incoming VM1 needs 3 hours time for running the job. here VM1 runs before 3.5 hours so VM1 is

TABLE 3.2 Stage:2 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1(3 hours)	
Long life		
Remaining unit	7	

short life job. Therefore VM1 store in 1st physical machine and need 2 core unit. So remaining capacity of physical machine is 7 unit.

TABLE 3.3 Stage: 3 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1(2 hours) VM2(1 hours)	
Long life		
Remaining unit	6	

In third stage new VM2 is arrive which need 1 hour for run and 1 unit capacity. So our remaining capacity is 6 unit for 1st physical machine.

In table VI, new VM3 is arrive. At the same time VM1 completed 1hour work and VM2 is finish.VM3 require 6 hours and 6 unit capacity. So our remaining unit is 1.

In the fifth stage, remaining hour of VM1 and VM3 is 1 and 5. New VM4 enter with 2 hours and 3 unit. But physical machine 1 is contain only one unit capacity so VM4 place in physical machine 2.

In sixth stage, VM5 is enter with 5 hours and 1 unit capacity. VM5 first check 1st physical machine. PM1 contain remaining capacity of 1 unit. So VM5 place in 1st physical machine. So remaining unit is 0 for PM1.

TABLE 3.4 Stage: 4 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1(1 hours) VM2 is Finish	
Long life	VM3(6 hours)	
Remaining unit	1	

TABLE 3.5 Stage: 5 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1(1 hours)	VM4(2 hours)
Long life	VM3(5 hours)	
Remaining unit	1	6

TABLE 3.6 Stage: 6 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1 is finish	VM4(2 hours)
Long life	VM3(4 hours) VM5(5 hours)	
Remaining unit	0	6

TABLE 3.7 Stage: 7 of example

	PM1 (Total unit= 9)	PM2 (Total unit= 9)
Short life	VM1 is finish	VM4(2 hours) VM6(2 hours)
Long life	VM3(4 hours) VM5(5 hours)	
Remaining unit	0	4

In next stage, PM1 is full so newly coming VM place in PM2. Show the final condition of example in table IX.

IV. RESULT

SYSTEM PERFORMANCE

In first graph, we define the placement process of VM. In existing work all short life and long life VM placement is done on same physical machine and in our proposed work, we arrange all short life VMs on same container and long life VM on same container. So our resource utilization is maximizing, show in graph.
In second graph, we define utilization of resource or PM. According to the Optimization function if the division of VM(mips) and PM(mips) is near to the 1 than fragmentation is less, so utilization of PM is more. And the value is the nearest to the 0 than the fragment is more, so utilization is less. Base on that optimized value of 1 and 0 we create graph.
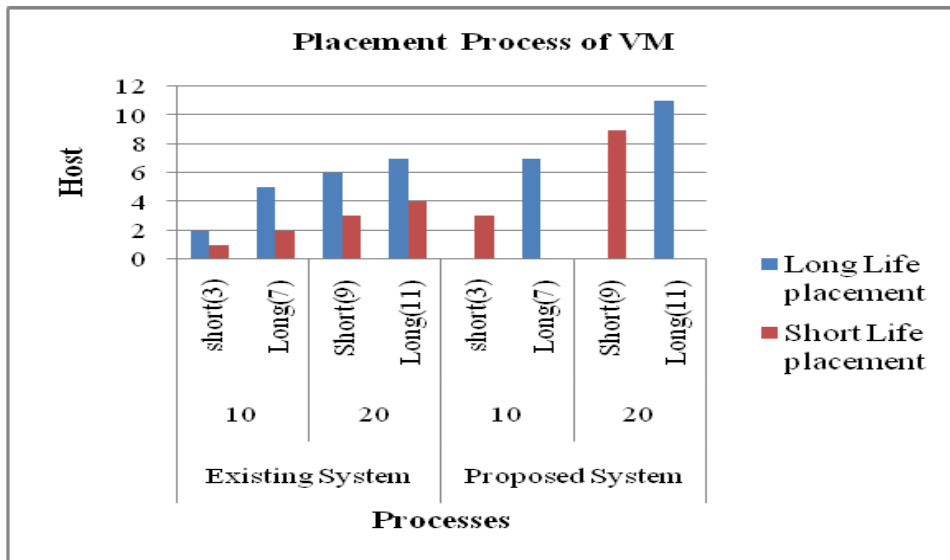
Fig. 5.0 Placement process of VM

In table 5.1, we define existing placement process. Here all short life and long life VM place in same PM.

Existing system			
10		20	
Short(3)	Long(7)	Short(9)	Long(11)
Long life placement 2	5	6	7
Short life placement 1	2	3	4

TABLE 5.1 Existing placement process

Table 5.2 defined our proposed strategy. Where we create short life and long life container.

Proposed system			
10		20	
Short(3)	Long(7)	Short(9)	Long(11)
Long life placement 0	7	0	11
Short life placement 3	0	9	0

TABLE 5.2. Proposed placement process

Table 5.3 shows the placement of short life job according to load in existing system and proposed system.

TABLE 5.3. Placement of short life job

Placement of short life VM		
	Existing system	Proposed system
0 to 2	7	7
2 to 4	3	3
4 to 6	8	6
6 to 8	7	0
8 to 10	5	0

In fig. 5.2 we define utilization of resource or PM. According to the Optimization function.
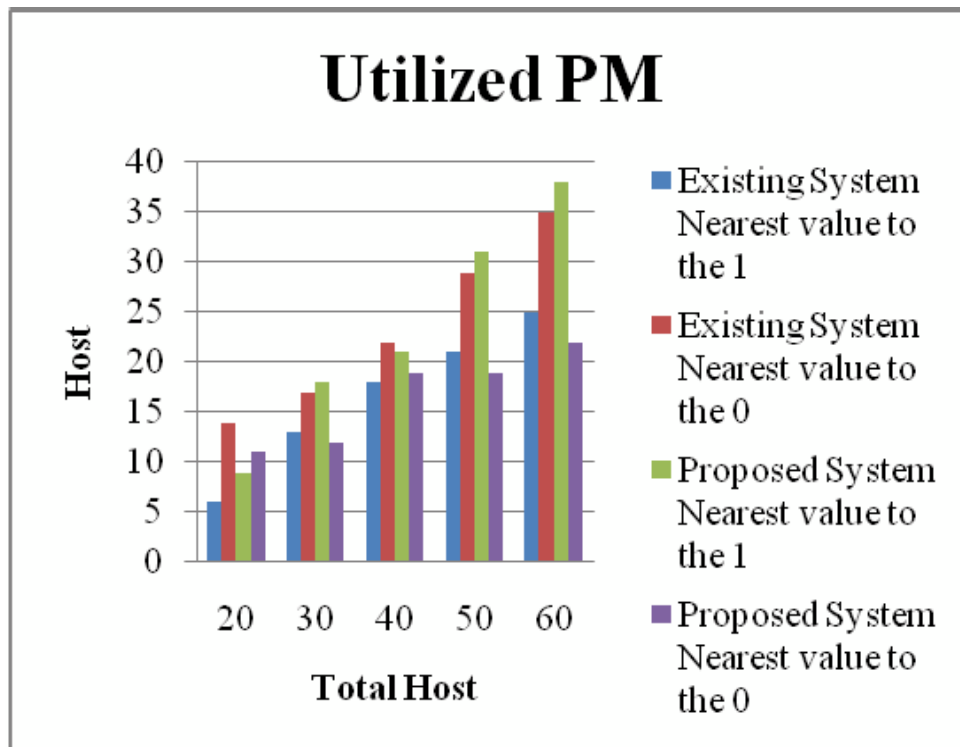

Fig. 5.2 Utilization of PM

Existing System			Proposed System		
	Nearest value to the 1	Nearest value to the 0	Nearest value to the 1	Nearest value to the 0	
20	6	14	9	11	
30	13	17	18	12	
40	18	22	21	19	
50	21	29	31	19	
60	25	35	38	22	

V. CONCLUSION AND FUTURE WORK

After doing rigorous survey on various issues in resource utilization, we found that load balancing, VM placement and fragmentation are the greatest issue in cloud computing. So we propose dynamic priority based spill over technique and add the concept of short life/long life container for solving the fragmentation issue. Our architecture maximize the resource utilization also we minimize fragmentation issue with using short life/long life container at physical machine in our architecture.

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