Implementing Cloud Scheduling Algorithm For Resource Allocation

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Candidate's Declaration

I hereby declare that the work presented in this report entitled "Implementing cloud scheduling algorithm for resource allocation " in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering Information Technology submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology ,Waknaghat , is an authentic record of my own work carried out over a period from August 2018 to May 2019 under the supervision of Dr. Ravindara Bhatt (Assistant Professor, Computer science and Engineering).The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Dheeraj Verma (151281)

This is to certify that the above statement made by the candidates is true to the best of my knowledge.

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ABSTRACT

Cloud computing has been proved as best solution for tasks that require high computation. This technology now has been accepted by many industrial giants of software industry. As most of the organization wants to cut off their hardware cost by using virtual resources instead of using actual hardware infrastructure which has to be installed by one company which is going to use that and it comes out to be very costly as compared to the virtual system. So in the past decade the cloud computing has flourished so much that now mostly every work is done on cloud.

But still cloud computing is facing various challenges in areas of virtual machine mapping to physical machines so that the tasks can be done efficiently. Virtual machine ordering on physical machine resources is still an area which require a lot of attention We are going to use dynamic computing is applied to virtual machine placement to minimize the number of active physical servers, so as to schedule those servers which are not utilized up to their maximum so that energy can be saved. In our project we have studied all the persisting algorithms static ones like round robin, max-min etc. We have also seen the efficient performance given by ant colony system (ACS) algorithm so we will try to combine other approaches like order exchange mechanism so that better results can be achieved by next algorithm.

We will further try to compare this algorithm with proposed matrix solution for virtual machine to physical machine mapping and also we will try to look into some machine learning algorithms so that we can find some things related to self-managed virtual machines.

CHAPTER1

INTRODUCTION

INTRODUCTION:

1.1 Introduction:

Now days Cloud Computing has become a very important and familiar topic all over the world. There are lot of technology like Machine Learning, AI on which programmers are working. Cloud Computing is one of them. It basically acts as a medium between users and server with the help of which Users able to access different pieces of information by using web browser. With this Technology one can eliminates the requirement of maintaining expensive facilities required for computing.

There are lot of features that cloud computing provides like:

(1). Multi-tenant Architecture/Shared Model: In this Model we just use the resource and release the resource.

(2). Pay-Per-Use Model/Metering Service: - Whatever we will use the units we have to pay for it.

(3). Dynamic Scalability and Elasticity: - Whenever websites are crash on special weekends we use cloud at that time. It allocates hardware dynamically online.

(4). Mobility/Broadband Heterogeneity:- Cloud can be access anytime from anywhere and use any kind of OS and hardware configuration.

(5). Disaster recovery Model:- Data centre is there to recover damage(10-15 Data centre).

CLOUD COMPUTING SERVICES OVER THE NETWORK

Cloud Computing Used as Service means that it Distributes a different Cloud Computing resources as per the demand and there are different data centres which provides these services. But as per the characteristics of cloud computing every User who is using services of cloud Computing have to pay as per usage of services.

It has Following Advantages:

(1)Facility of Service To Self: Any User can use free tier or paid tier in order to use cloud computing services.

(2). Elasticity of resources: Main reason in exponential increase is due to the elastic environment which it provides to the users.

(3). Facility of Measured services:- It means that uses have to pay only for those services of cloud computing what they are using.

There are three types of Cloud Services:

(1).SAAS (Software as a Service)

- All services are available over internet.
- Clients will have to pay as they use the resources.
- Provide independent structure.
- No need to install the software on PC.
- Computing Resources Managed by Vendors.
- Examples Gmail, Google Docs.

PROS:

- Available anywhere from any machine.
- No need to move can do anything from anywhere.

CONS:

- Migration can become an issue and browser versions can also put up some issues.
- Overall performance tends to dependent on the internet

(2). PAAS (Platform as a Service)

It provides an environment where developers can construct, Compile and stimulate their program without being afraid of the underlying Infrastructure. Examples Google Engine, Windows Azure etc.

PROS:

- It is a very cost effective method for development.
- Provides a growing market for Developers.
- Web applications can be deployed easily.
- It provide both public and private version that can be deployed.

CONS:

- It has some migrations issues.
- Developers working in particular environment are restricted to particular tools and development languages.

(3). IAAS (Infrastructure as a Service)

This offers virtual platform which basically works on physical resources provided by the cloud provider. Due to virtualization multiple clients can access various resources as per their requirement e.g. Amazon Ec2.

PROS:

- Provide a huge amount of hardware infrastructure virtually.
- Can be scaled as per future requirements and workload that it face.

CONS:

- There are some security concerns.
- There can be network delays due to internet speed.

VARIOUS CLOUDS

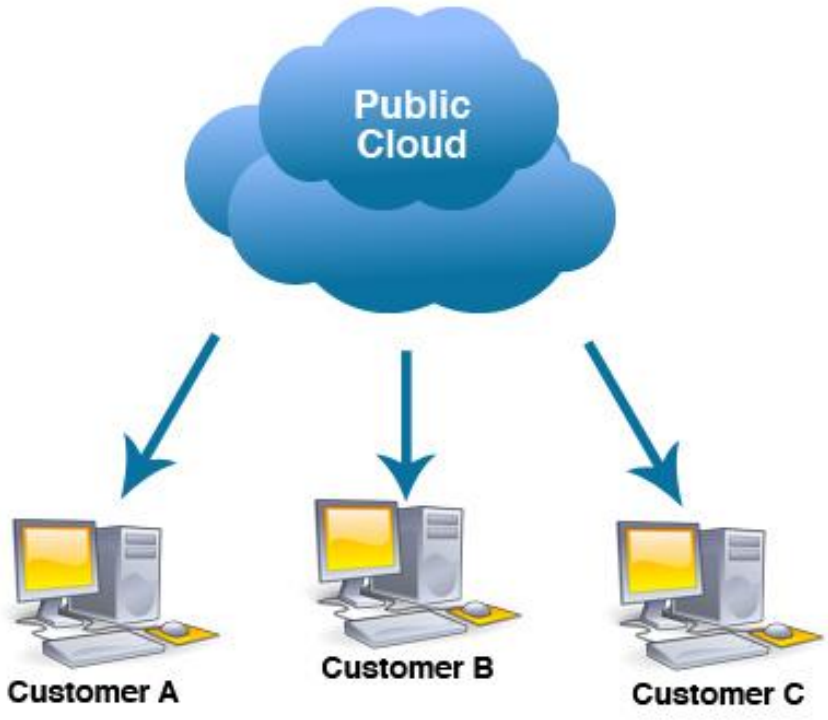
There are 4 types:

(1). PUBLIC CLOUD:

Public Clouds are managed and owned by companies which offer direct access to the clients to use their resources. If Users are using public Cloud then they don't need to purchase the supporting Infrastructure or the hardware or software.

Features are Pubic Cloud:

- Computing Services and Storage of IAAS are flexible and scalable.
- Used By Face book, Gmail, LinkedIn.



1.0 Public Cloud

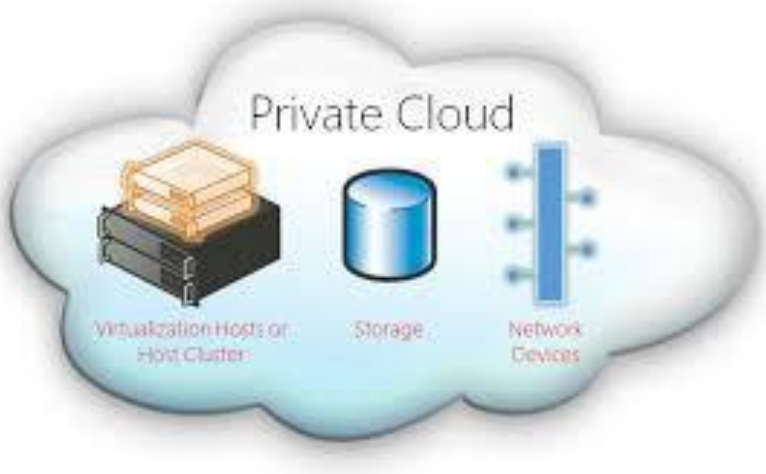
(2). PRIVATE CLOUD:

Private cloud provide infrastructure which is designed only for a particular organization which can be managed internally or externally by any other party. The efficiencies of these private clouds are generally more with providing facility of multi-tenancy etc.

Features Of private Cloud:

(1). Controls services with a self-service interface that allows the IT staff to rapidly arrange, allocate, and distribute the IT resources on-demand.

(2) It is Scalable means it has high level of utilization through virtualization and size of data centres.
(3) Used by defence, banking etc.



1.1 Private Cloud

(3). HYBRID CLOUD:

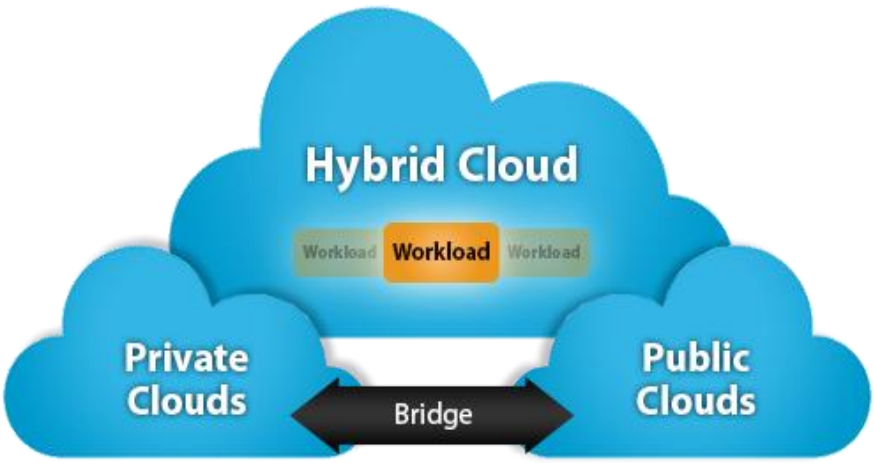
Hybrid Cloud consists of both Public and Private Cloud. It is Dynamic and frequently changing workloads. It offers the private cloud's high security featured coupled having fast connection and easy to access features of the public cloud. This cloud has popular due to benefits to enterprises.

Features OF Hybrid Cloud:

(1). Profits by a comparative minimal effort approach as the general population cloud.

(2). Coordinates open distributed computing with on location cloud equipment that conveys control of security and directions in the hand of the organization.

(3). Will work behind a firewall, like the private cloud.



1.2 Hybrid Cloud

1.2 PROBLEM DEFINATION:

In recent years, Cloud technology has evolved as a system that is being extensively used for monitoring virtual resources and provides physical resources to clients over internet.

This technique is used by almost every company nowadays. As everyone wants to cut down there hardware cost and wants to maximize their profit by getting required system virtually. Most of the Cloud providers nowadays like Microsoft, Amazon, Adobe, VMware, IBM providing different kind of services as per demand of the user. They provide cloud services on use and pay basis.

However, more data centres results in increased energy supply, increased usage which finally results in increased heat dissipation, decreases the computational power and higher operating costs. Due to which it puts a heavy load on environment as well as on energy resources. It has been seen that servers consume 0.5 % of the world total electricity, which is estimated to be quadruple by 2020 if current trend continues [4].

Cloud computing in general has various issues and some of these are stated below:

- As now all industries , corporate sector, government sector all moving on cloud computing that's why there is an exponential increase in cloud computing services due to which power consumption has also increased.
- Resource allocation is one of the main areas to focus as increasing user request has led to increased load on data servers due to which either there is high probability of failure or the QOS promised to client is compromised.
- Current mapping strategies i.e. VM (Virtual machine) to PM (Physical Machine) mapping do not take into account the previous statistics of that particular Physical Machine. So it is very much necessary to develop such system which can learn on their own by using Machine Learning algorithms.

Cloud computing match various virtual machines to resources that are provided by the cloud distributers using virtualization. Virtual machine scheduling techniques used to handle tasks so that it can match the VMs and then deploy them to different physical machines (PM) to achieve resource sharing, by doing so it will help us to achieve a particular quality of service and better system performance.

On-going Tasks which have acquired some resources from physical machines if there is some fault in physical machines or in virtual machines then we have to migrate the VMs

efficiently and there is also need to allocate these VMs so that it does not affect the performance of that physical machines so there are various factors we need to look. Improved genetic algorithms, Host fault detection (HFD) algorithms are there but we need some more statistical approach to handle these kinds of problems. Also we need such systems which can learn on their own to produce optimal results and enhance performance by learning from their past experience.

1.3 OBJECTIVES:

The things which we will try to achieve in this project are:

- To implement persisting algorithms for VM scheduling and try to optimize their performance so that overall cost and efficiency can be increased.
- To develop learning based algorithms that can improve the performance and cost of overall system.

1.4 METHODOLOGY:

There are a lot of options available nowadays for cloud simulation. Each software has its own merits and demerits and some limitations also.

Table 1.1 presents the comparison of various cloud simulation platforms and presents evaluation and analysis on different software or hardware.

Simulator	Underlying Platform	Programming Language	Software/Hardware
CloudSim	GridSim	Java	Software
CloudAnalyst	CloudSim	Java	Software
GreenCloud	Ns2	C++, OTcl	Software
NetworkCloudSim	CloudSim	Java	Software
EMUSIM	AEF, CloudSim	Java	Software
SPECI	SimKit	Java	Software
GroudSim	-	Java	Software
DCSim	-	Java	Software

In this project, we will be working mainly on Cloud-SIM as our cloud simulator mainly due to following advantages:

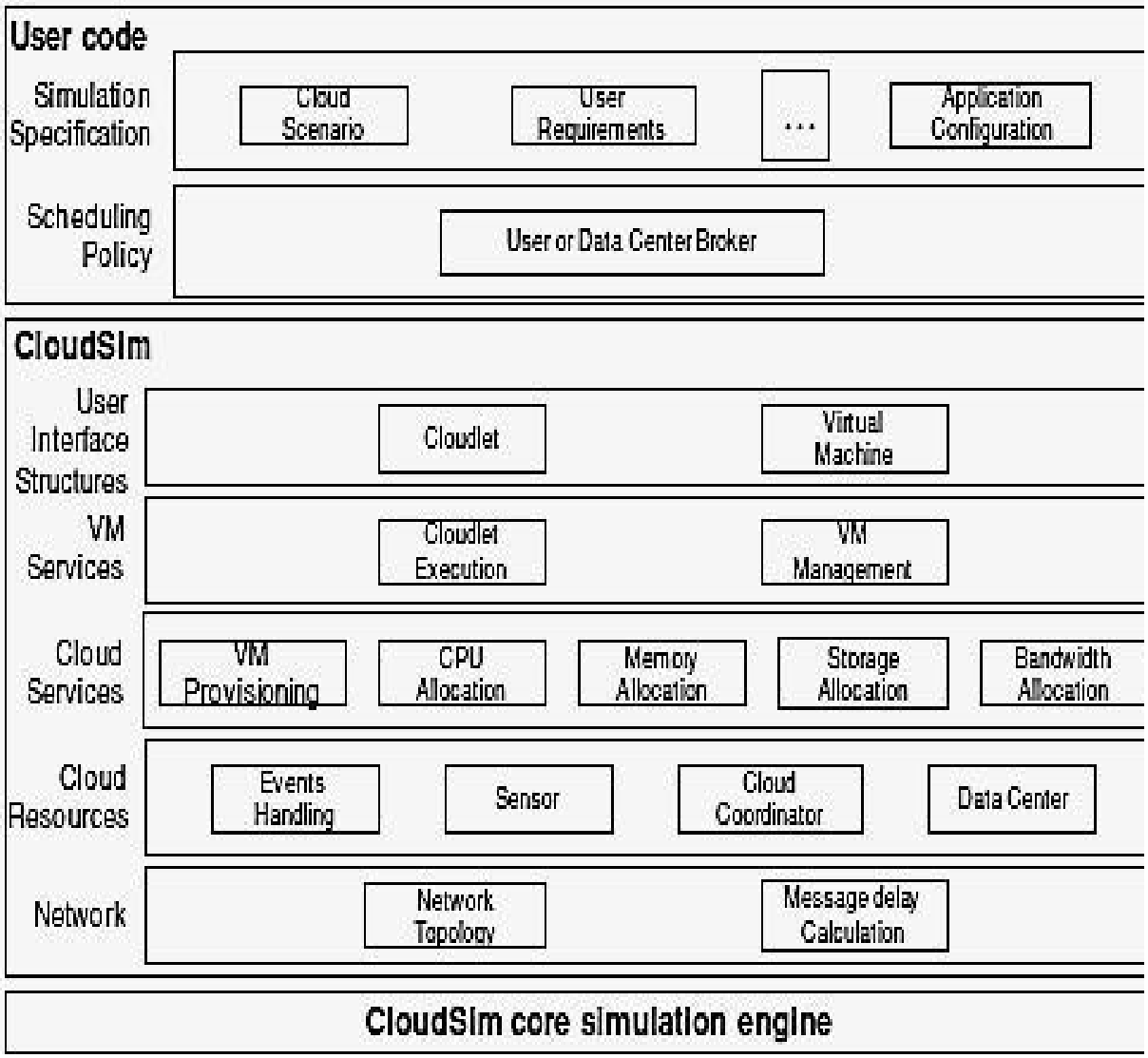
- Simulating on particular software than on real cloud is very much cost efficient as it provides seamless opportunities for users to try various different conditions.
- Most of the algorithms can be simulated on Cloud Sim and it provides a very detailed output about execution time, turnaround time etc.
- Most of the Cloud simulation software's like Cloud Analyst, SIMIC toolkit are further extensions of Cloud-SIM.

Now to make our cloud simulator work on different scenarios we have to make particular changes and to add some files so that it can test various data sets.

In this project we are mainly focused on to simulate existing task allocation algorithms and try to optimize them and we try to make some self-learning algorithms which can on their own allocate particular tasks to PMs so that it do not affect their performance and it takes into account their previous history of allocation. This project mainly focuses on to give a dynamic algorithm for virtual machine scheduling so that the tasks can be managed properly and can be allocated properly on PMs so that the overall execution time can be minimized and can maximize the utilization of resource. Proposed dynamic learning based algorithms emphasis on various areas and provide results these optimal results cannot be acquired by static scheduling algorithms like min-min , max-min.

1.5 ORGANIZATION

The Layered Cloud-Sim architecture is described below:



1.3 Cloud-SIM Architecture

The CloudSim Design

There are various levels in the cloud-SIM software and each layer combining with the different functions allow us to conduct various simulations and modelling. It help us to simulate various algorithms by providing necessary resources virtually e.g: various data centres which can be created on Cloud-Sim as well as it provides dedicated memory areas and it provide real time monitoring system.

The major components of Cloud-SIM are as follows:

The cloud-SIM software can be divided into 2 main categories as mentioned in the diagram (1.4)

First is the user code platform which sits over the cloud-SIM architecture. User code section comprises of two different sections.

Simulation Specifications: It basically tells that we can put up different algorithms and can stimulate them as per the required scenario.

Scheduling Policy: Cloud-SIM offers us a huge variety of options to set our own algorithms and can simulate them on various parameters.

Second is the cloud SIM platform which has various layers to it first is the user interface structures, VM services, Cloud services, Cloud resources and at last we have cloud simulation engine.

This provides us with various parameters that have to be defined by the users like user base, data centres and also it allocates various virtual machines to the defined data centres.

CHAPTER 2

LITERATURE SURVEY

Virtual machine scheduling in cloud environment is an NP problem. Heuristic algorithms were being used to solve these problems. All the traditional Batch mode Heuristic usually focus to optimize the process completion time and balances load properly so that overall system can provide good quality of service QOS. In this section we have discussed all the persisting algorithms as well as the optimized solutions to those algorithms.

R Santhosh[1] came up with the idea to optimize the heuristic based algorithms through dynamic scheduling using check pointing algorithm in 2013. He developed the check pointing algorithm. The main idea behind the algorithm was to migrate uncompleted tasks and start execution from where it lasted. In this, checkpoint intervals are provided for on-going tasks in the queue and ready for execution. If task misses deadline, it is then migrated to other VM and execution of task begin from where the last checkpoint interval was saved.

Its main problem was that it doesn't give the best solution; the tasks which are picked at random have a high probability of missing the deadline.

Another example is max-min algorithm. This technique provides the execution and completion time of all chores and assign them resources in physical machines based on a decision rule. According to this algorithm, the task with maximum completion time is picked and provided to the resource with minimum execution time where:

The main problem of max min technique is that it works for only for homogenous system where all big and small task may not be clearly bifurcated.Upendra Bhoi[2] provided an efficient one step further version of the above mentioned max-min technique. The main concept behind the technique was to allocate tasks which has high completion time to resources which has overall less process completion time, so that the bigger tasks can be completed on machines which have little less execution time so that smaller tasks can be mapped to the resources with high execution time and all this can be done parallel.

Xia-Fang Liu[3] In this paper they have developed an approach for this NP Hard problem i.e. OEMACS is basically a combination of ant colony system coupled with order exchange and migration local techniques for virtual machine placement in cloud computing, the linking of VMs is dependent on artificial ants based global search.

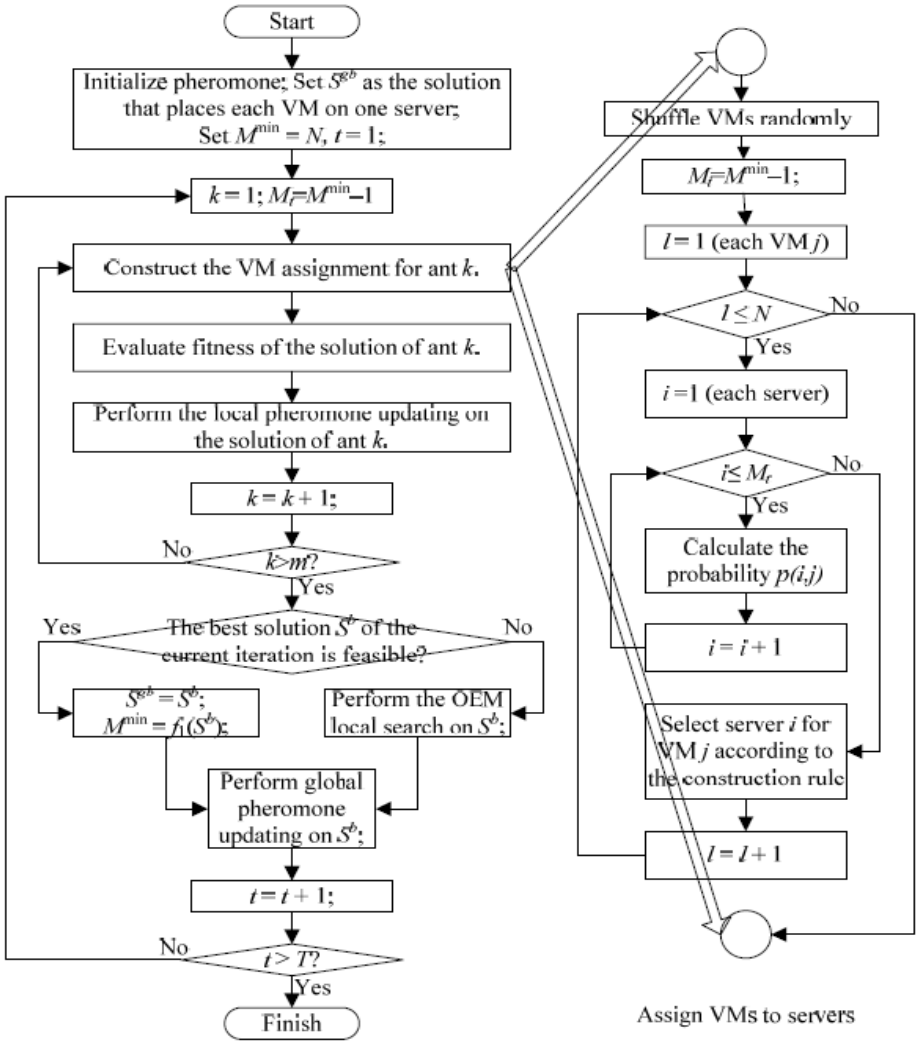


Fig: 1.4 Flow Chart of OEMACS

This technique divides pheromone among virtual machine pairs, which gives a connection among the virtual machines on the same machine (server) and keeps the data of good virtual machine groups through learning from past incidents. Moreover in this the number of severs given for placement of virtual machines tend to decrease as the generation number grows, avoiding possible computation wastage. Due to this distinct behaviour and a dependent global search nature of ACS make this particular technique efficient for large problems. This technique is seen an efficient approach to virtual machine placement problems.

Xinying Zheng[4] In this they provided an approach to put real time virtual machine in cloud environment. The main things which have been conducted in this paper are as follows:

- In this a mathematical framework has been created for virtual machine placement. A virtual to physical mapping probability matrix has been developed by taking in account all the necessary resources i.e. resource requirements, virtualization overheads, energy effectiveness, server authenticity.
- Second a normalized probability matrix has been used to effectively migrate VMs in order to improve system efficiency.
- An extra server solution has been proposed to check the number of servers presently online in every control cycle. This proposed model can efficiently decrease the system power consumption and also made it to deal with high workload.This paper has done various simulations and has proved that a huge amount of energy is saved as compared to other static schemes.

The Dynamic VM algorithm used for migration is as follows:

```
Probability matrix X initialization
for each column
        Normalize the X by dividing the probability of the
        Current hosted VM and obtain normalized matrix A
 end for
        While there are values greater than Mig(threshold) in A and
        Migration round less than Mig(round) do
                1. Pick the greatest value in the matrix diz
                2. Move VM z from the current PM p to PM z
                3. Update particular values X in the rows p and z
                4. Update matrix A in rows p,z and column i
        End while
```

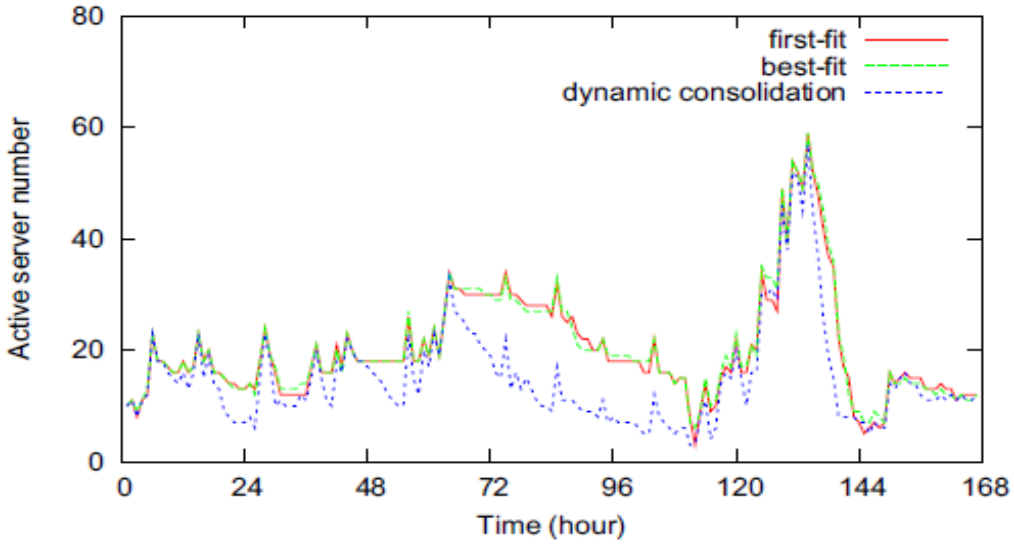


Fig. 3. Hourly active server numbers in a week.

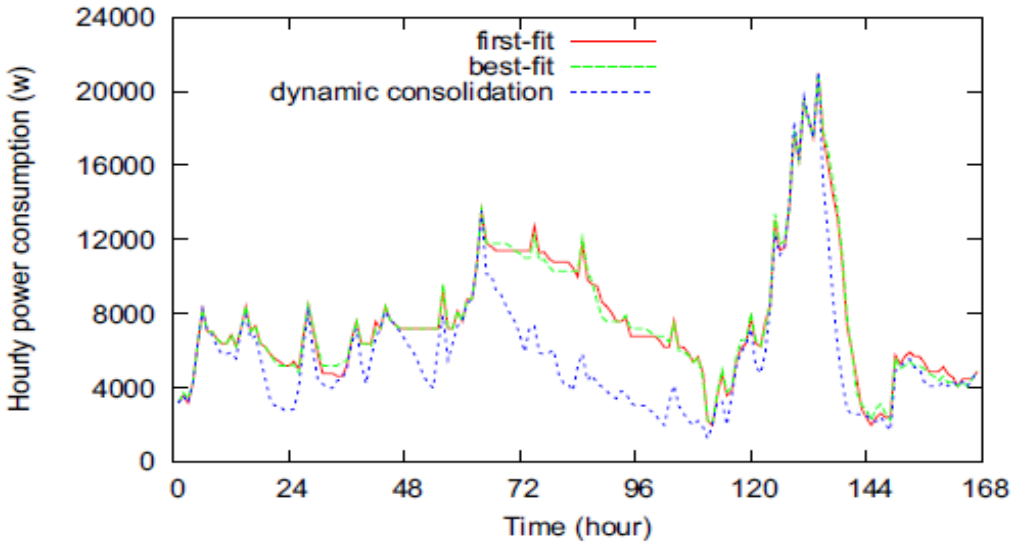
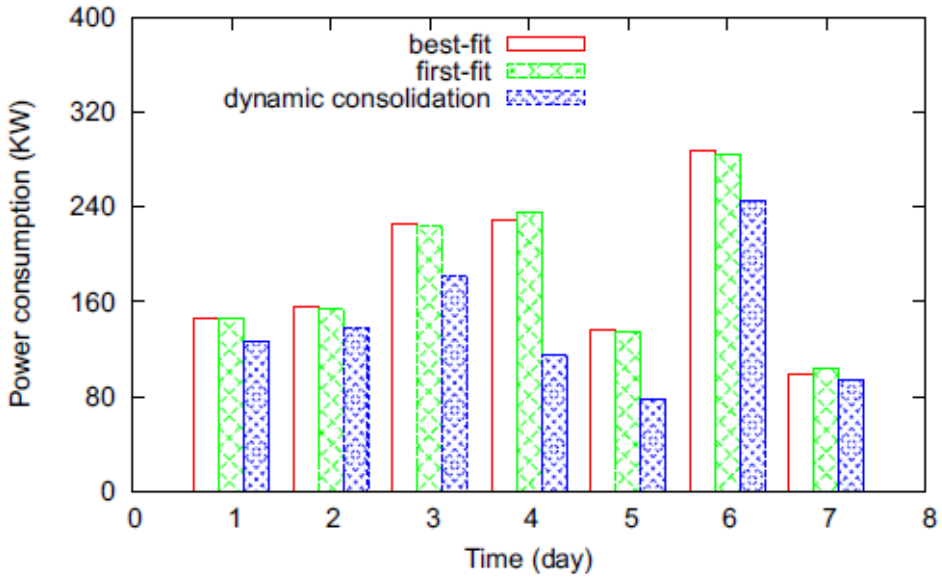


Fig: 1.5 Results from [4]



These proposed methods proved that the dynamic virtual machine placement provide good results than the static algorithms like best-fit, first-fit.

There are many nature based algorithms which can be used as well for scheduling cloud resources for example ant colony, particle swarm optimization and artificial honey bee algorithm.

The artificial honey bee algorithm is also a very well nature inspired algorithm which can be used for scheduling resources in cloud environment efficiently. Main features of artificial honey bee algorithm are that it basically keeps a check on all the servers in the population and always provide upcoming request to a particular VM which is not overloaded. This overall calculates the fitness of each server and tries to allocate the best possible server to the client.

Description of artificial honey bee algorithm:

Step 1:The algorithm first starts with assigning (n) scout bees randomly placed in a particular search place for example say (n=100).

Step 2: The fitness of all the sites in the population visited by the scout bees are calculated and evaluated i.e. First scout bee is taken and trained with the data let's say (200 correct from 1000).Second scout bee is taken and the process is repeated and we get 50%. This process is repeated on all the bees and fitness is evaluated.

Step 3: The evaluation of 100 bees

1	2	3	4				99	100
20%	50%	60%	30%	.....	.....	.....	35%	72%

Step 4: Then (m) sites will be selected randomly from (n). Then we choose best (e) sites.

Step 5: In this way it chooses best bee for each site to form next bee population.

Zhen Xio[5] papers which has designed and implemented an automated resource management system that achieves efficient VM placement techniques. They developed resource sharing systems which can minimize overload in system efficiently while sideways reducing the number of servers used.

Also they have given other ideas by introducing concept of "skewness" to calculate the utilization of a server which is not utilized properly. So by minimizing the skewness of system it can improve the overall performance by utilizing servers in face of multidimensional resource constraints.

They provided a load forecast solution which can capture and analyse the resource usage in coming time of applications without even checking in the virtual machines. These techniques get the main rising trends of resource usage and this decreases the virtual machine placement problem to a great extent.

The Skewness Algorithm proposed

$$skewness(p) = \sqrt{\sum_{i=1}^{n}\left(\frac{r_i}{\overline{r}} - 1\right)^2},$$

N=number of resources in consideration

Ri= utilization of the ith resource.

r = average utilization of all resources for server p.

CHAPTER 3

SYSTEM DEVELOPMENT

3.1 SOFTWARE REQUIREMENTS

The software which are required and we are going to use are as follows and are a little description is there how these software's going to help us to simulate various results.

- Net beans
- Cloud-SIM
- Cloud Analyst

Net beans:

In this project we are going to use Net beans as our main platform. As it gives consistent chances to simulate various algorithms. Support for Java standards and platforms. The IDE provides solution for all Java development platforms including latest Java standards.

Cloudsim:

CloudSim is the tool which can be used for various simulations and which provides cloud developers to check the operation of all their policies so that they can achieve a controllable and repeatable environment. It also keep a record of all the obstacles before deployment of that service/algorithm in real time for the actual world. Cloud-Sim is similar to a box full of different cloud scenarios which provide seamless opportunities to simulate different algorithms without being afraid of real time environment. Also it provides the developers with important classes in which they can define the requirements of whatever machine they want. At the same time it provides a huge option for scalability as per demand or as per overload.

The major characteristics possessed by Cloud-SIM simulator are as follows:

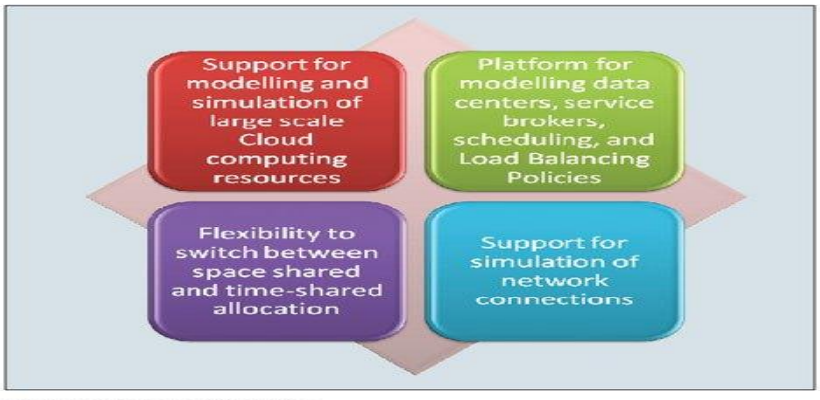


Figure 1: Features of CloudSim

Cloud Analyst:

Cloud Analyst is also an upgraded version of Cloud-SIM which provides a graphical interface and provides comparisons in tabular and graphical form. It provides a huge set of functions; we can use Cloud Analyst by importing the project into Net beans IDE and can create our own algorithms and then simulate these algorithms on various parameters that are provided by the Cloud Analyst software.

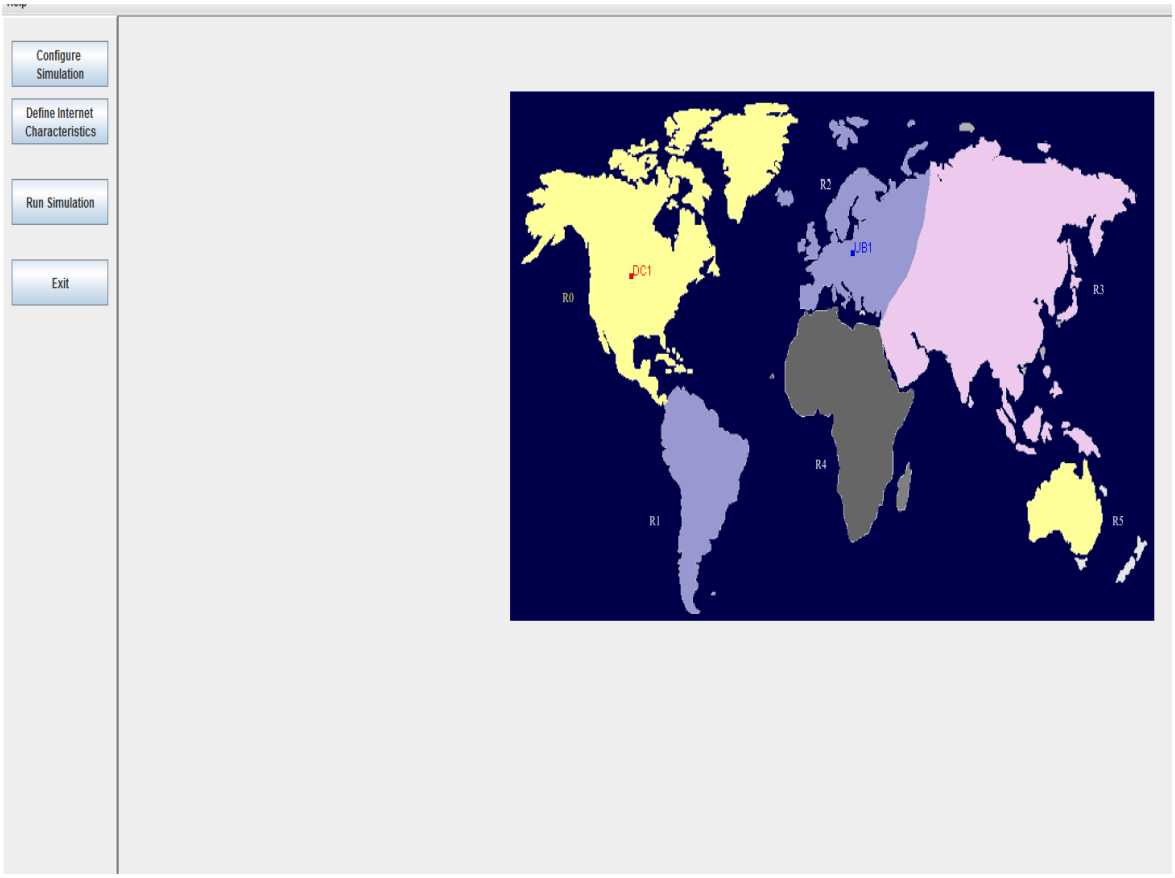


Fig:1.6 GUI Cloud Analyst

Main features of Cloud Analyst are as follows:

3.2 Main configuration:

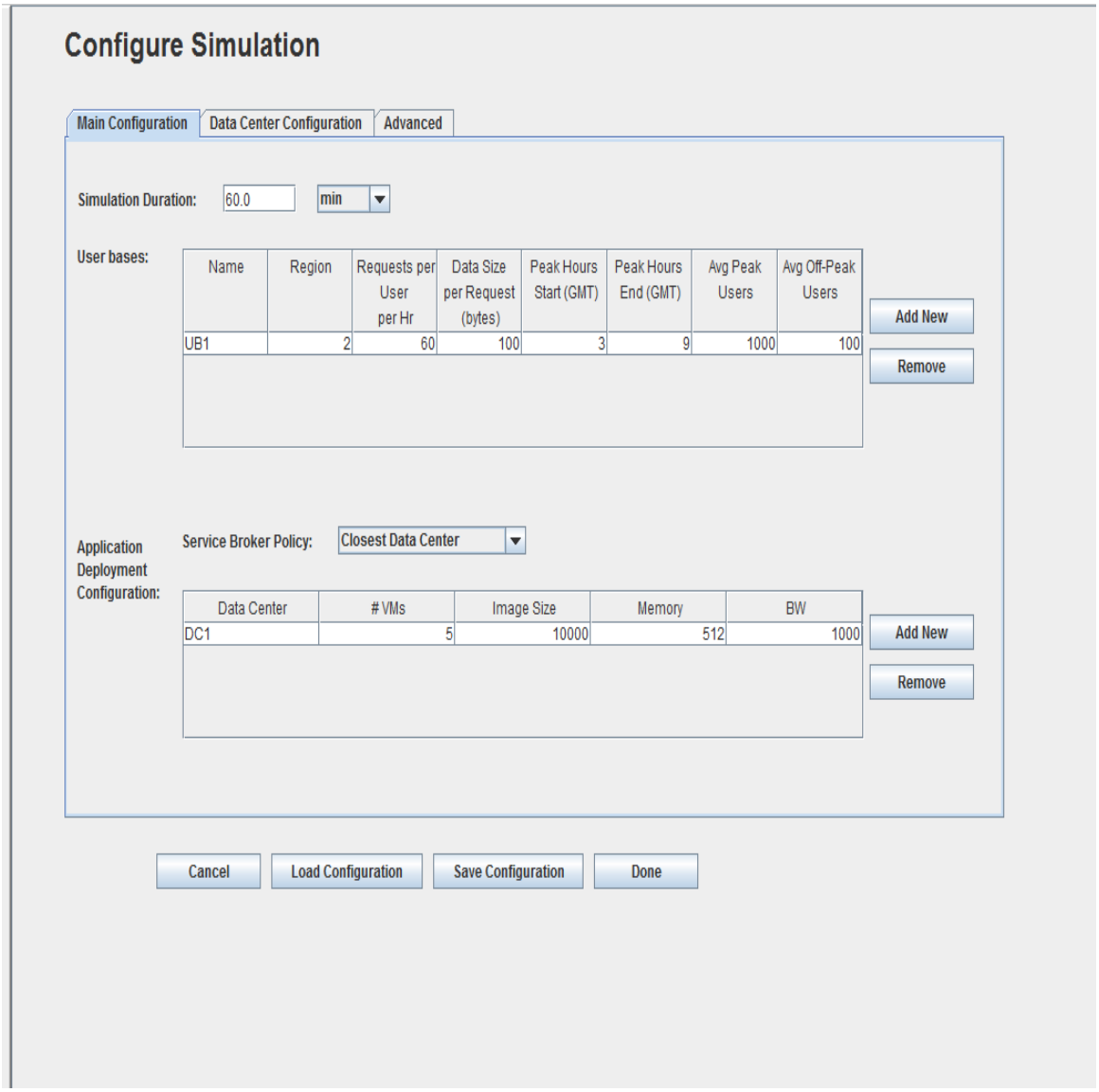


Fig:1.9 Main configuration of Cloud Analyst

Here in the main configuration tab we have various parameters like simulation duration, User base, Application Deployment Configuration, service broker policy etc. We can create as much user base we want and can stimulate results on them, can create as many data centres we want and can also choose the service broker policy. We can also load our own configurations and can also save them for later use.

Data centre configuration:

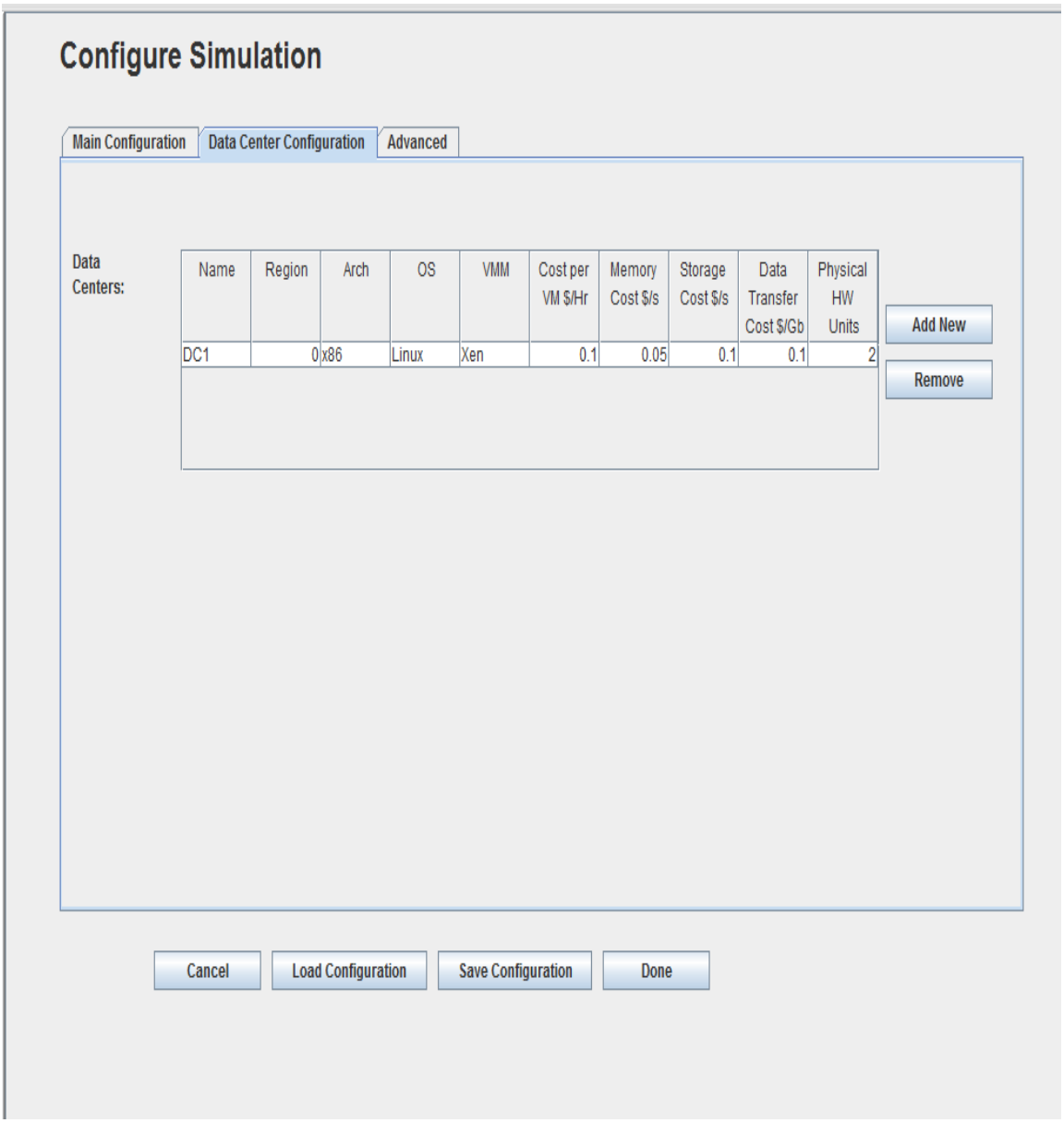
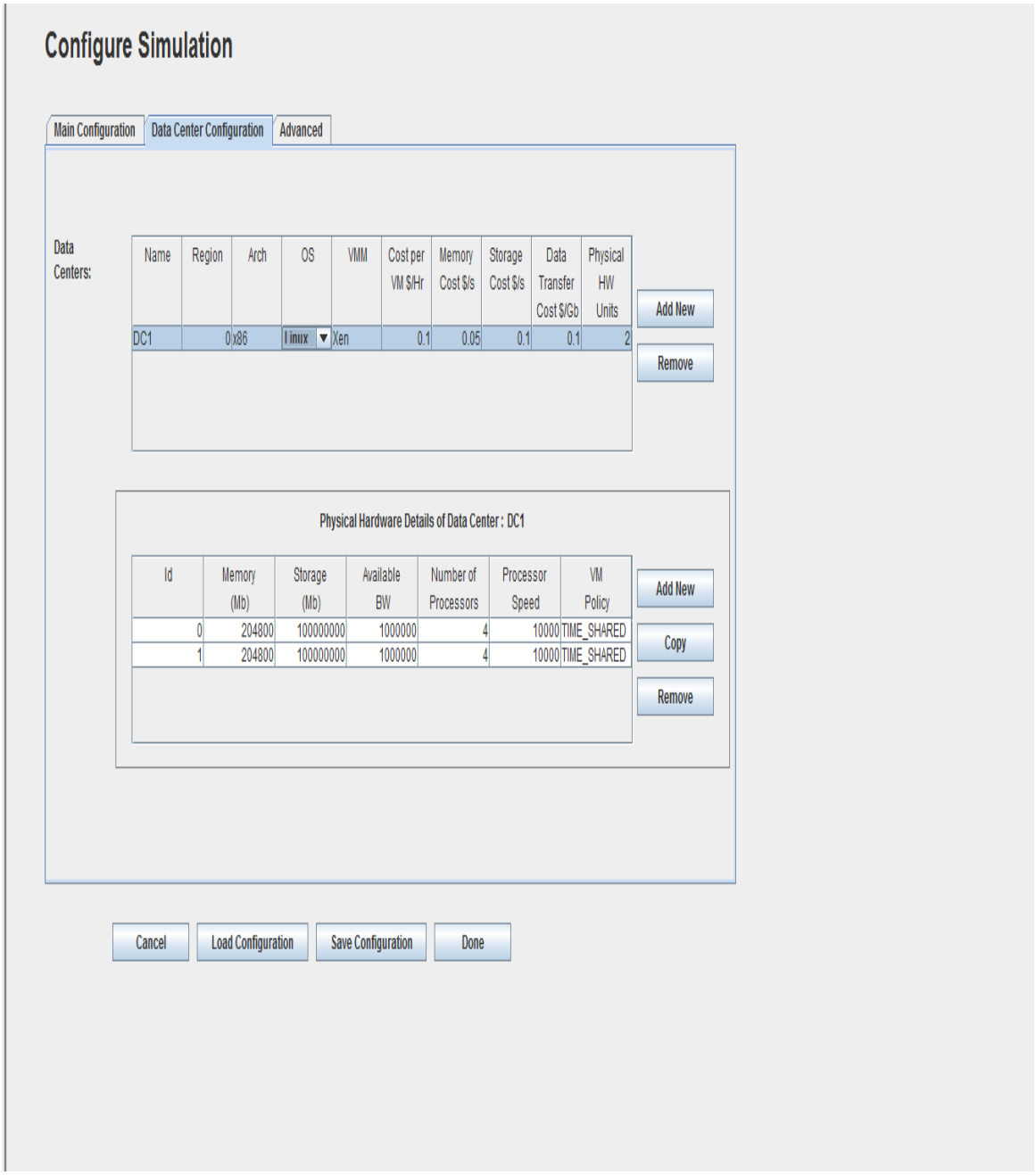


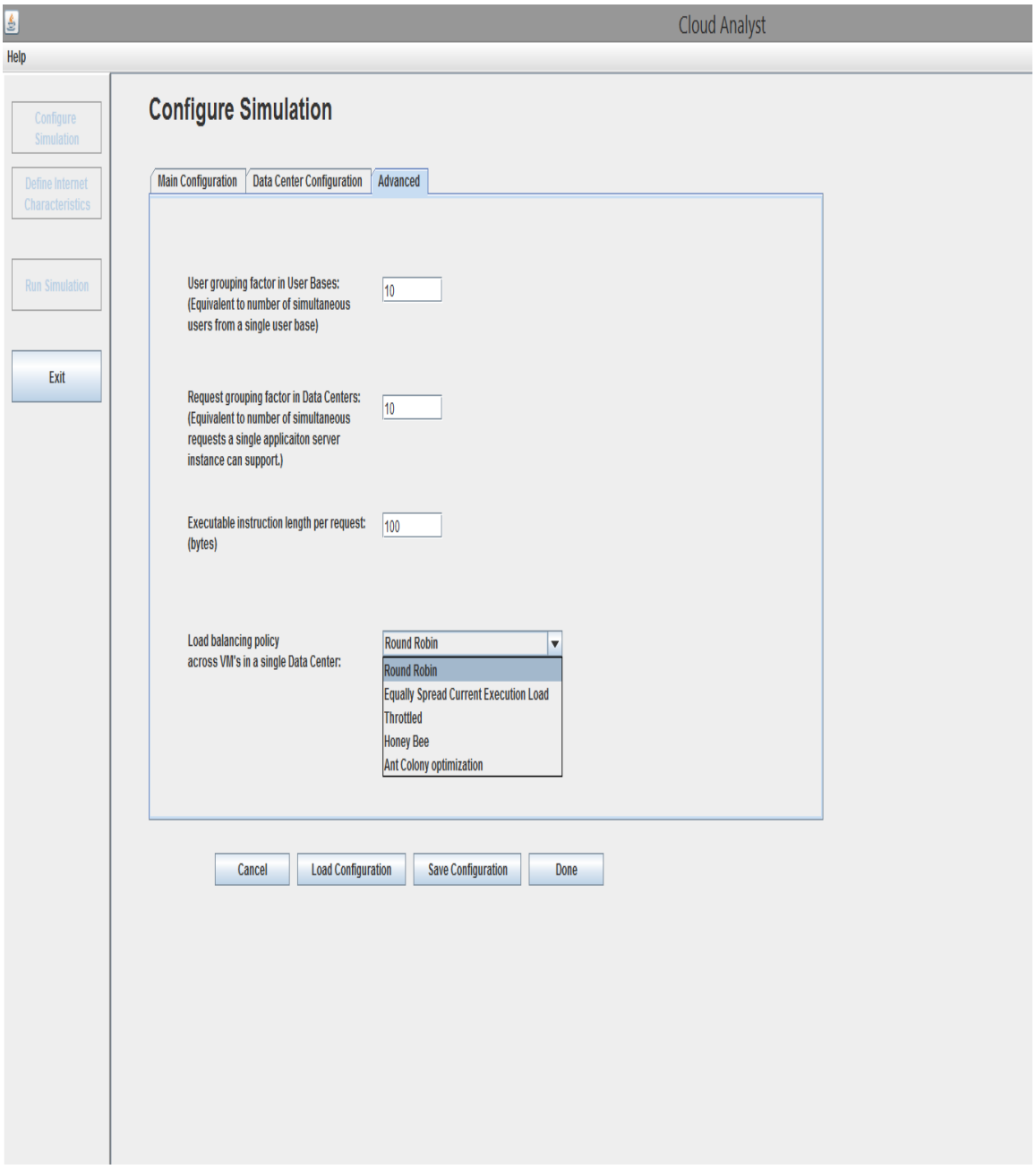
Fig:1.8 Data centre configuration

In data centre configuration we can add various data centres and can create a server cluster for more complex cloud simulation these all functions comes under main configuration. The data centre configuration has various parameters which has to be defined first e.g. name, region, architecture, OS, Cost per VM, memory cost, storage cost, energy units etc.



In data configuration we can change the parameters like memory (Mb), storage, number of processors, processor speed, VM policy. But in cloud analyst we have one type of linux operating system and we have only x86 architecture. But main advantage is that we can simulate it on different number of processors which help a lot in achieving real time environment.

Advanced configurations:



1.9 Advanced Configuration

In this particular configuration system we have option to choose for load balancing policy across VMs. We can choose or we can also add our own algorithms in this GUI and can use that algorithm for other simulations.

We have to make certain changes in the Cloud Analyst project in Net beans to introduce some new algorithms in the cloud Analyst interface.

3.3 Proposed Model:

In the present time we have a large amount of existing algorithms for virtual machine placement and every algorithm is provide a new way to tackle the VM to PM mapping problem and reduce energy consumption to a particular extent. All the different methodologies like ant colony optimization and the idea of defining a transition probability matrix we will try to work on this and try to simulate both on different parameters and will see which provide more reduction in energy consumption and provides better VM placement solution so that the overall execution time can be decreased.

Ant Colony optimization (ACO) takes inspiration from the foraging behaviour of some ant species. These ants deposit pheromone on the ground in order to mark some favourable path that should be followed by other members of the colony.

Pheromone:

A chemical substance produced and released into the environment by an animal, especially a mammal or an insect, affecting the behaviour or physiology of other of its species.

Ants navigate from nest to food source. Ants are blind.

Shortest path is discovered via pheromone traits.

Each ant moves at random.

Pheromone is deposited on path.

More pheromone on path increases probability of path being followed.

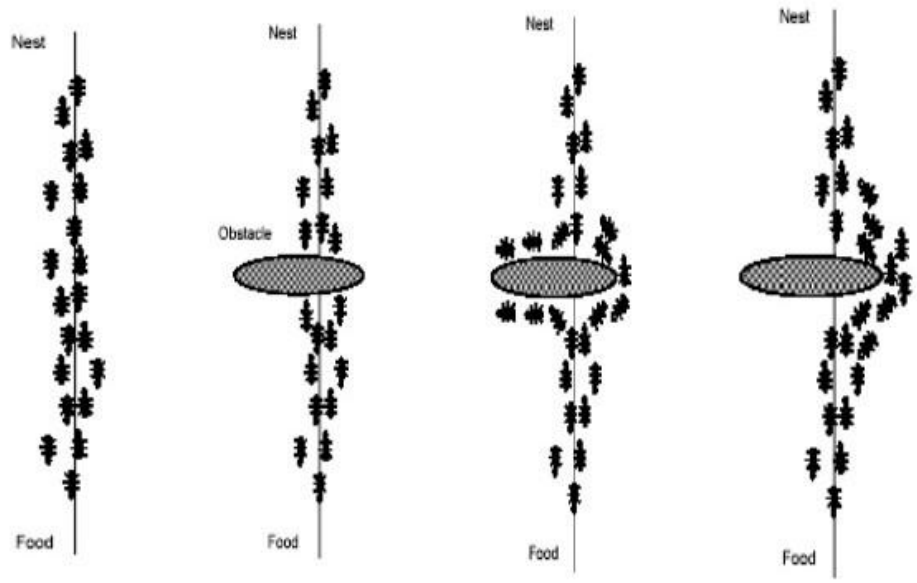
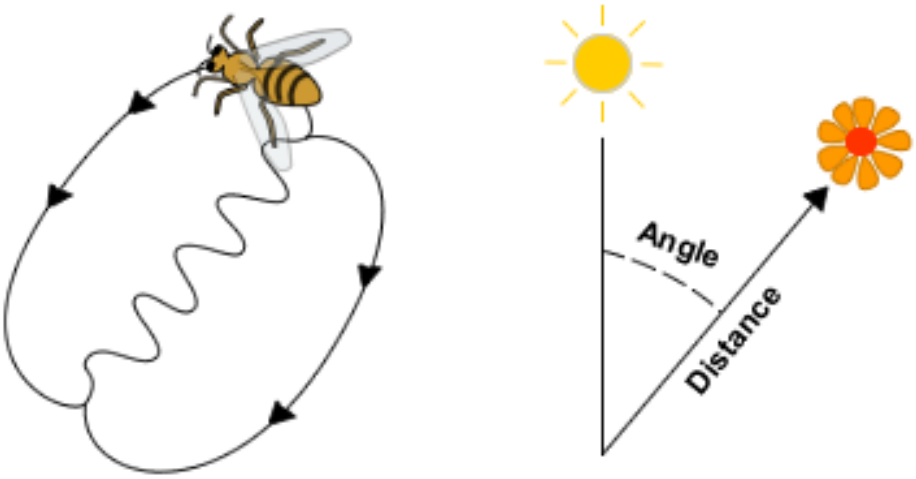


Fig 2.0: Natural behaviour of ants

Honey Bee Algorithm

Waggle Dance



2.1 Waggle Dance

If a bee found a great source of food then she wants to tell about it to other bees and they perform waggle dance in order to do so. Bees used to perform this dance which is their way to tell other bees about the destination, they tell about the direction to follow and how far the destination is away from the source.

Proposed HONEYBEE algorithm:

Step 1: Initialize the VM's with random solutions.

Step 2: Then try to evaluate the fitness of the population using particular method i.e. calculate fitness ().

Step 3: Start the while loop till stopping criterion is not met.

Step 4: Select sites for neighbourhood search.

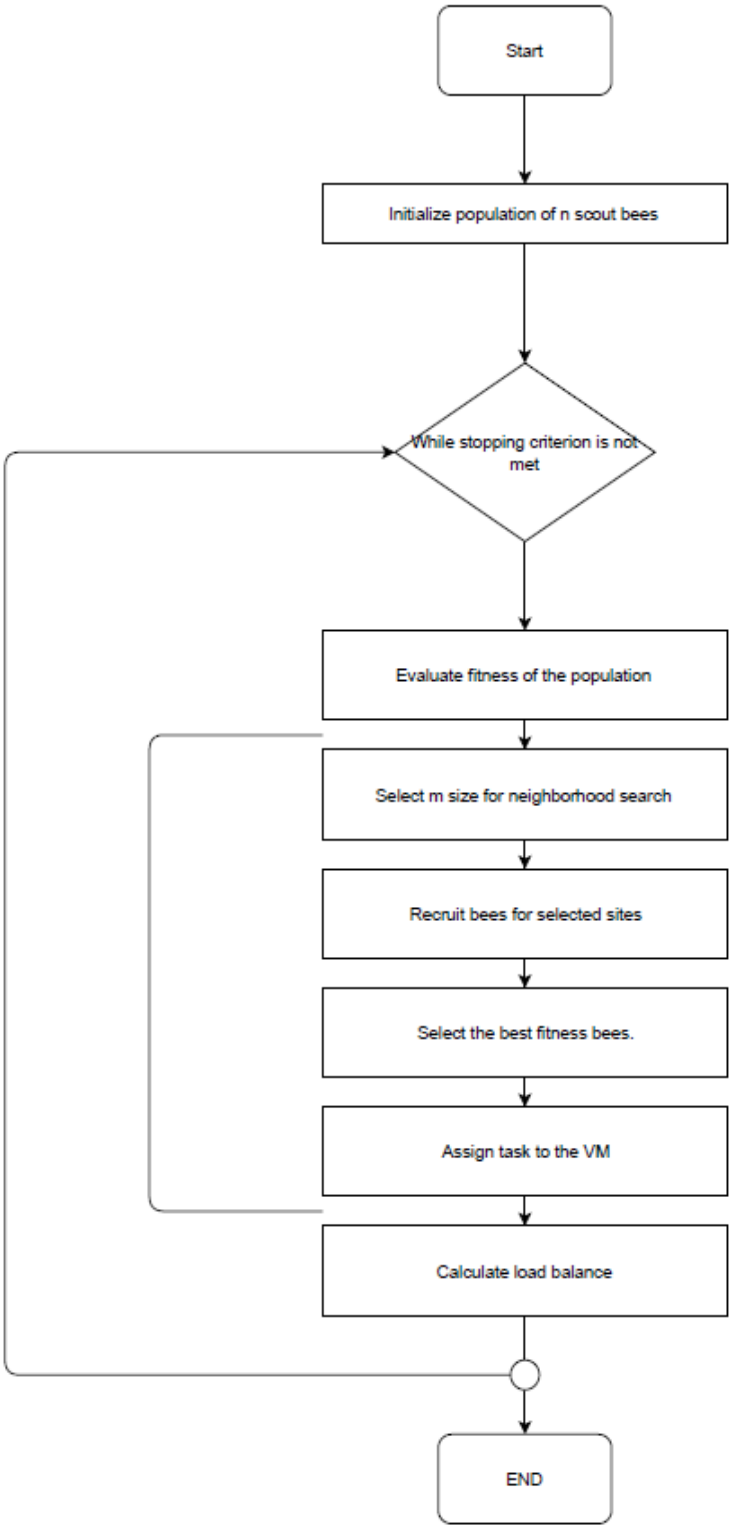
Step 5: Recruit bees for selected sites.

Step 6: Select the fittest bee for next iteration.

Step 7: Assign remaining bees to search randomly and evaluate their fitness.

Main parameters in this algorithm:

1. Number of scout bees (n).
2. Number of sites selected (m) out of (n) visited sites.
3. Number of best sites recreated for the best (e) sites (n2).
4. Number of bees recruited for the other (m-e) or (n1).



2.2 Flow chart of honey bee algorithm

So we will try to simulate the proposed Ant colony algorithm and the honey bee algorithm on cloud analyst and we will compare all these nature influenced algorithms with standard algorithms like round robin, Active VM load balancing algorithm. We will compare all parameters like average time taken for processing and try to improvise these algorithms to reduce overall average time for processing.

CHAPTER 4

PERFORMANCE ANALYSIS

4.1 Experimental results:

For simulation we are using cloud Analyst. We have performed simulations on static heuristic algorithms i.e. load balancing on VM using round robin, equally spread current execution load.

Data Centre parameters which we used in Cloud analyst

Data Centre	VM's	Memory	BW
DC1	10	1024	2000
DC2	15	512	1000
DC3	5	2048	1000

User Base parameters which we used in Cloud Analyst

User Base	Region	Request Per Hour	Data Size
UB1	0	100	2000
UB2	3	160	1000
UB3	5	100	1000
UB4	1	260	1050

Round Robin:

Round Robin mainly allocates the requests on an alternate basis. For example if we have 2 servers than the load balancer will allocate server 1 with (1,3,5,7...) and server 2 with (2,4,6,8....).

Disadvantages:

But the main problem with round robin is that it works well for identical server but if the servers are not identical them there is high probability that the server can get overloaded. Identical server here means that all servers are identical in terms of processor, RAM memory, hard disk space etc. But nowadays this is always not the case so we cannot rely on round robin in every environment.

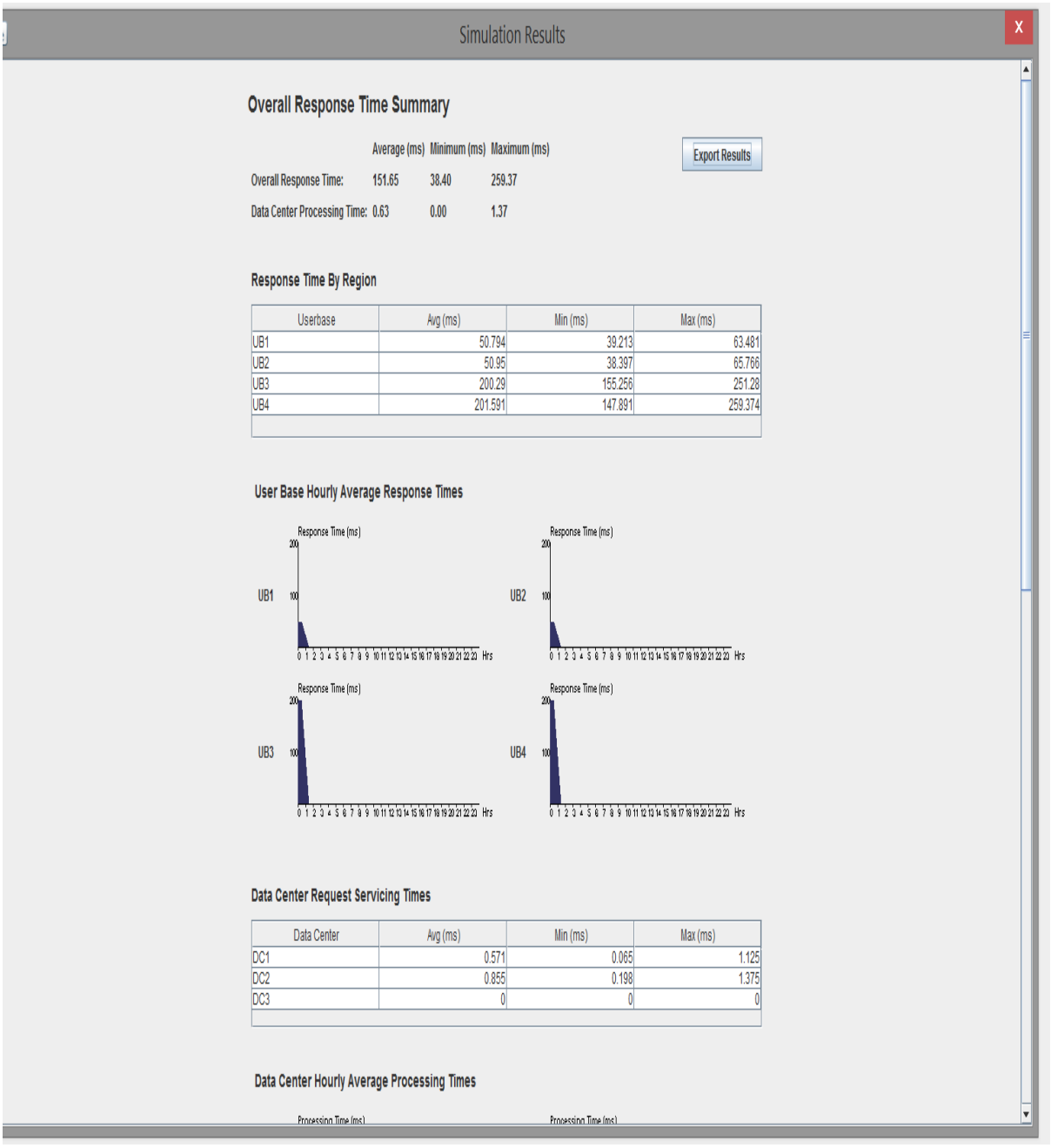


Fig: 2.3 simulated results of round robin algorithm

Equally spread current load:

This algorithm help to attain a balanced environment i.e. it mainly distribute the load in a very balanced manner all the upcoming requests are distributed in such a way that no server remain underutilized. The main concept behind this algorithm is to equally distribute the entire load across all the servers.

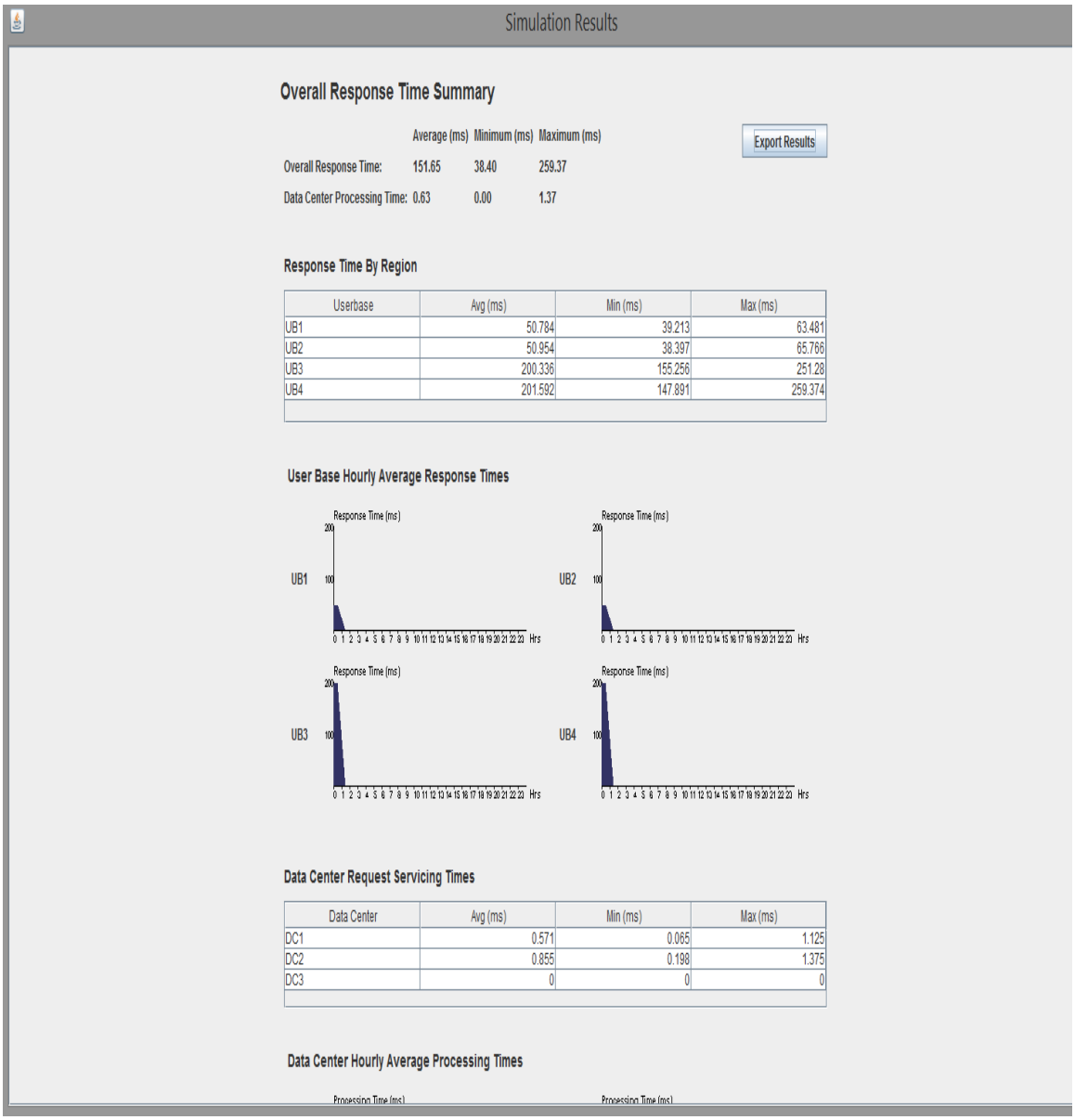


Fig: 2.4 simulated results of equally spread current load

Ant Colony Optimization:

Here in Ant colony optimization we achieved overall response time of 110.85 but here the data processing time is 0.50

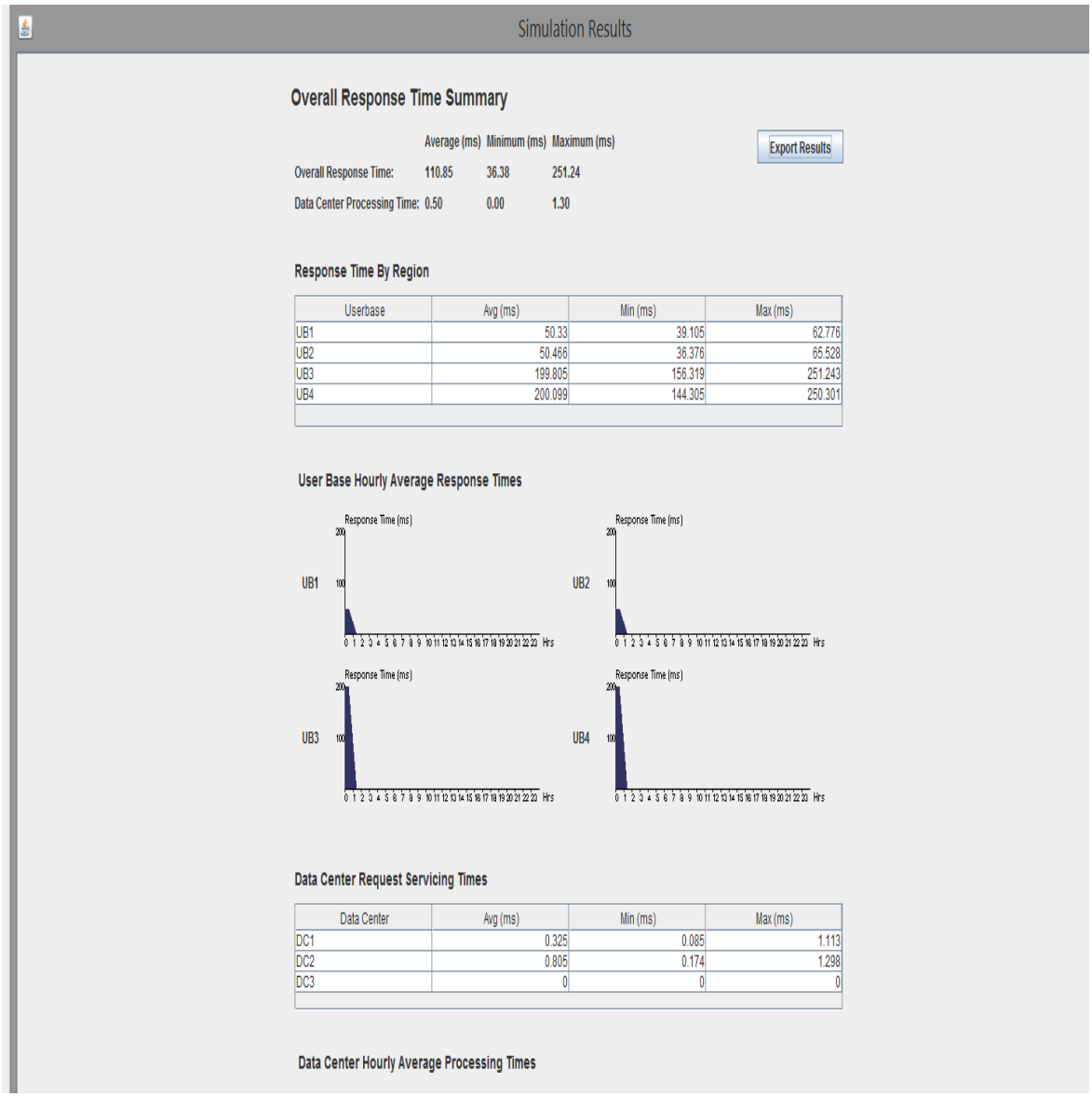


Fig: 2.5 simulated results of Ant Colony optimization

Honey Bee Algorithm

In honey bee algorithm we were able to achieve overall response time of 136.66 but here data processing time is 0.48. This is where the honey bee algorithm is better than the ant colony optimization, as it always take the fittest solution possible. Honey bee also performs well in environments where servers get overloaded so it always migrate the task to underutilized servers. This therefore helps us to achieve a better data processing time.

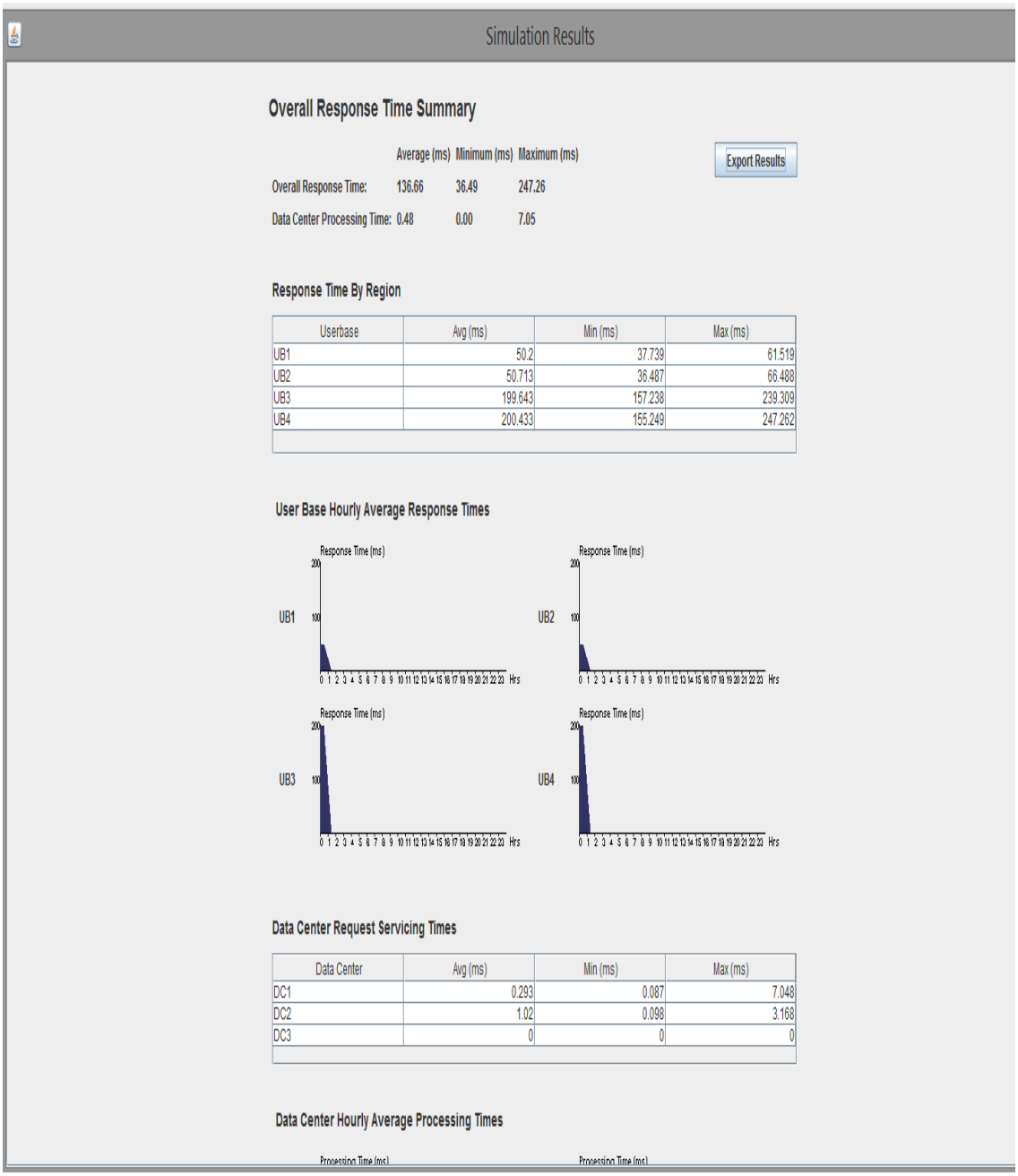


Fig: 2.6 simulated results of Honey Bee algorithm

Comparison among all the above discussed algorithms

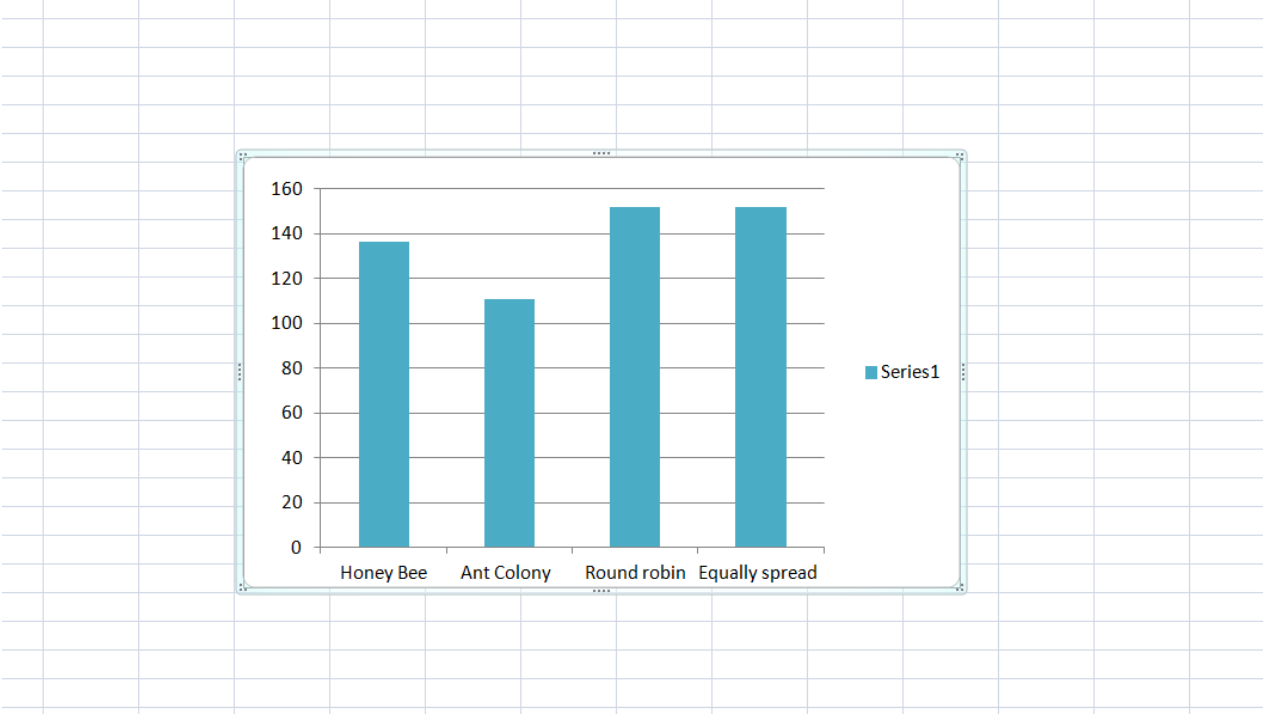


Fig 2.7: Comparison between overall response time

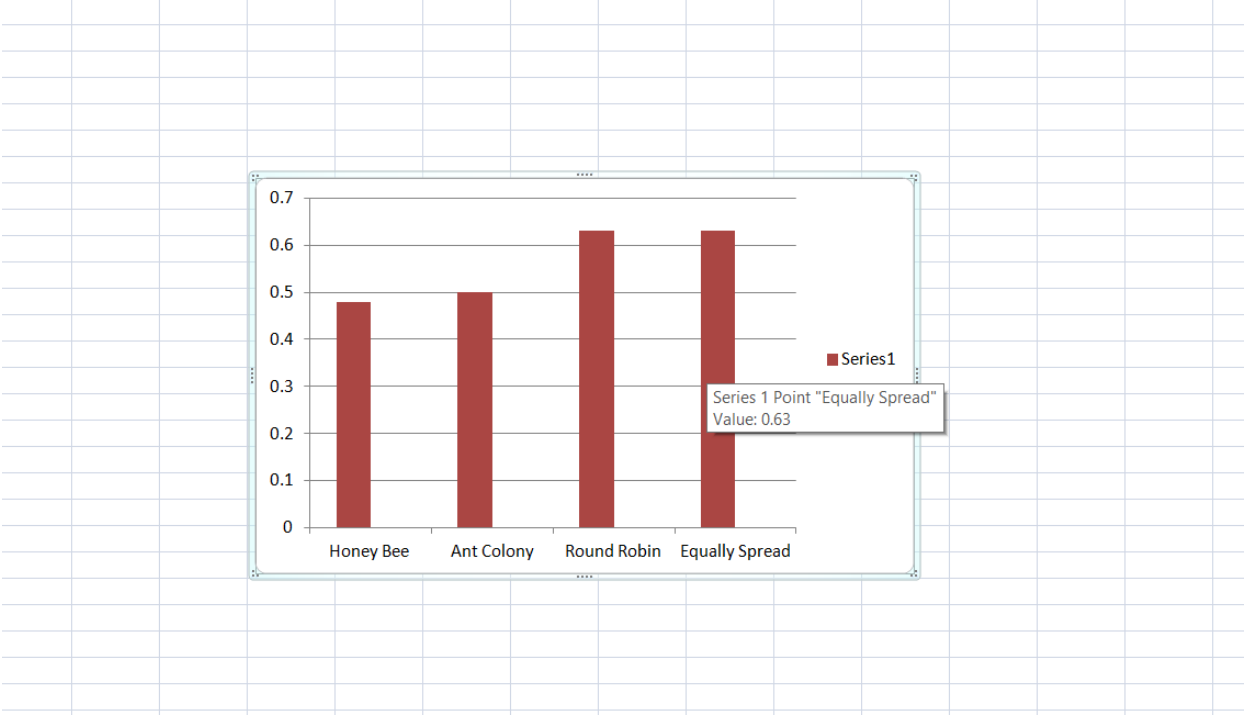


Fig 2.8 Comparison between data processing time

So from above results we can state that the nature inspired algorithms works very well in comparison with the standard algorithms. The honey bee algorithm overall response time is more than the ant colony optimization. But honey bee algorithm overall data processing time is less than the ant colony algorithm which is due to the fact that the honey bee algorithm always consider the fittest solution.

CHAPTER 5

CONCLUSION

5.1 CONCLUSION

We have studied various ideas and algorithms in this project to achieve a better cloud environment which has overall better processing and response time. We simulated some standard ongoing algorithms like round robin, equal load balancing, throttled etc. And shifted our focus on nature related algorithms like ant colony optimization and honey bee algorithm both of these algorithms provide better results than the standard algorithms

From above results and simulations we have seen that the nature inspired algorithms like ant colony algorithm, honeybee algorithm performs very well in accordance with the Round-robin as well as equally spread current execution load. In honey bee calculating the fittest solution by considering their waggle dance and calculating the overall fitness, then again scouting bees help in achieving desired results i.e. better overall processing time.

So nature inspired algorithms can be used for scheduling purpose and obviously it can be further optimized as well there are a lot of options and paths to carry further research so that better performance can be achieved by these resources and overall cost can be reduced.

5.2 Future Work

In the above discussion we have seen that nature inspired algorithms perform somehow better than the standard ongoing algorithms. Ant colony algorithm which exploits the pheromone strategy and honey bee algorithm similarly use waggle dance and get the better solution from a given population, these algorithms can be further optimized to achieve a better overall response and processing time. Honey bee algorithm somehow takes more processing time in some conditions and for those set of problems round robin performs well. So we can consider the persisting problems in round robin and can combine it with honey bee or ant colony algorithm so that overall it works more efficiently.

There are many things in cloud scheduling environment which can be further optimized like data processing and response time are important but one can also try to reduce cost of these resources and overall energy consumption so that it become more cost effective and energy efficient. Nowadays machine learning is also playing a vital role so we can also consider work in field of intelligent VMs which can on their own decide which particular machine to select for a particular task so that more efficiency can be achieved.

REFERENCES

1 Santhosh R, Ravichandran T. Non-Preemptive Real Time Scheduling using Checkpointing Algorithm for Cloud Computing. International Journal of Computer Applications. 2013 Jan 1;80(9).

2 Bhoi U, Ramanuj PN. Enhanced max-min task scheduling algorithm in cloud computing. International Journal of Application or Innovation in Engineering and Management. 2013 Apr 2(4):259-64.

3 Xiao-Fang Liu An Energy Efficient Ant Colony System for Virtual Machine Placement in Cloud.

4 Dynamic Virtual Machine Placement for Cloud Computing EnvironmentsXinying Zheng Yu Cai Michigan Technological University Houghton, MI 4993.

5 Zhen, XiaoWeijia Song, Qi Chen.Dynamic Resource Allocation Using Virtual Machines for Cloud Computing Environment

6 Stelios Sotiriadis, Nik Bessis, Ashiq Anjum, Raj Kumar Buyya. An Inter-Cloud Meta-Scheduling (ICMS) Simulation Framework: Architecture and Evaluation.

7 Stelios Satyriasis self-managed virtual machine scheduling in Cloud systems

8 Medhat A. Tawfeek, Ashreaf El- Sisi Cloud scheduling based on Ant colony optimization.

9 Stelios Sotiriadis, Nik Bessis, Designing a new Inter-Cloud Simulation Platform for integrating large-scale resource.

10 Qaisar Shaheen, Muhammad Shiraz, Suleman Khan,Towards Enegy Saving in Computational Clouds.

11 Jing Yao, Ju-hou He Load Balancing Strategy of Cloud Computing based on ABA.

12 Nitin Das K.C, Melvin S George Weighted round robin and honey bee algorithm in cloud environment.

13 Wes J. Lloyd, Olaf David, Mazdak Arabi The virtual Machine (VM) Scalar. An Infrastructure Manger Supporting Model.

14 Daniel Warneke, Odej Exploiting Dynamic resource Allocation for Efficient Paarallel Data.

15 Yuri Demchenko, Canh Ngo, Cees de Laat Intercloud Architecture Framework for Heterogenous Cloud Infrastructure.

16 Li Liu, Zhe Qiu A survey on Virtual machine scheduling cloud computing.