

Fault Recovery through Weight Based Methodologies in Cloud Computing Environment

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Abstract— Cloud computing is the term used for model which provide convenient and on-demand network access to a shared pool of computing resources, applications, storage and services, which are stored on a remote location that can be rapidly released with minimum interaction in a well-organized way. A typical cloud consists of several elements such as clients (nodes), virtual machine and virtual server. Virtual machine and virtual server are used to distribute the load among the nodes and enhance the network throughput, reduce execution time and battery consumption. When the load is not equally distributed among the nodes, chance of error occurrences will be increased. The fault tolerance approach is required for reducing the number of error rates in mobile distributed network. The task allocation model is used to allocate tasks to various mobile nodes. In this model, the tasks among processors are allocated on the basis of capacities of processors and communication links. The issue of failure can be resolved by task redundancy, which is provided by backup system that is attached with each node of the remote cloud distributed systems. This paper focuses on designing algorithms for making the system fault tolerant, balancing the load among the nodes and help to recover the fault in minimum amount of time.

Keywords— *Cloud Computing, load balancing, task allocation, task redundancy, fault tolerance.*

I. INTRODUCTION

Cloud Computing is the environment which provides on-demand & convenient access of the network to a computing resources like storage, servers, applications, networks and the other services which can be released minimum efficiency way. User retrieved data and modified data which is stored by client or an organization in centralized data called cloud. Cloud is a design, where cloud service provider provides services to user on demand and it is also known as CSP stands for “Cloud Service Provider”. It means that the user or the client who is using the service has to pay for whatever he/she is using or being used and served. It is a technique which gives a huge

amount of applications under different-different topologies and each topology gives some new specialized services [1].

In cloud computing there is no need to know the physical location, configuration of the system which provides the service. Basic characteristics of clouds are: Massive scale, homogeneity, virtualization, low cost software, advance security, services orientation and geographic distribution. The user can use the application without installation and by accessing internet user can manage their personal files at any location through cloud computing. Cloud computing provides more effective computing using the concept of centralizing storage, processing, bandwidth and memory [4].



Figure 1.1 Cloud Computing Environment

Cloud computing is computing model, in which large number of nodes are connected in public or private network, to provide vigorously scalable infrastructure for data and file storage. It refers to the application and services which is run on a distributed network using virtualized resources and accessed by the common internet protocol and networking standard. In cloud computing user can access, retrieve and modify the data from their remote location which is stored by user or an organization in centralized way over the cloud.

It is a design where cloud service provider, offer the services to user on demand using the resources using the cloud service provider. It means that the user who used the service has to pay for whatever he/she is using or being used and served. It is a technique which gives a huge amount of applications under different-different topologies and each topology offer some new specialized services [16] Load balancing is one of the most significant security mechanisms in cloud service, and it is required to distribute the dynamic local workload evenly across all the nodes. Load balancing is a process in which the total load or data of the network is distributed to the individual nodes to formulate the proper utilization of resources and to improve the response time of the work. With this we can remove a status in which some of the nodes are under loaded while some others are over loaded. A load balancing algorithm, it depends on the present behavior of the system that is how it completes their job and it does not consider the previous behavior of the system which is dynamic in nature. The load can be measured in the form of CPU load, amount of memory used, delay or Network load.

There are two different models of cloud computing

1. Based on deployment model
2. Based on service model

The deployment model tells you where cloud is located and for what purpose we can use it. It is mainly distinguished by their size and access. There are four types of deployment model, which are:

Public cloud: In this cloud, resources allocated to the nodes are publicly. Applications are used in this cloud on pay-peruse basis. Public clouds can be managed by government organizations or business. it is open for public usage and their cost of usage is also free.it is better suited to business which is used to manage the load across the nodes for Example google drive and sky drive [13].

Private cloud: In this cloud, resources that are used within an organization are limited. It is more secured as employees in an organization can access the particular data only. It is secure based environment that is protected by firewall under the governance of the IT department. The data stored in this cloud is more secure and only accessed by the authorized user. It is mainly managed by the organization and third party or combination of both. For e.g. Banks [9].

Hybrid cloud: In this cloud, there is a combination of both public and private cloud. The services used within the organization are control by the user and resources which are allocated to complete the work need to be delivered externally are controlled by the service provider. It is beneficial for the large organization and provide greater flexibility. In this cloud workload is divided among the cloud according to the user need [9]. Community Cloud: This cloud is used by those organizations which have same concerns like security requirements; mission or policy. This is managed by

organizations within a community or by the third party auditor. It is a multi-tenant setup which is shared between several organizations that belong to an explicit group which has similar computing. The community cloud is share similar privacy, performance and security concerns. The main objective of these communities is to achieve their business related work [13].

II. LOAD BALANCING IN CLOUD COMPUTING

Load balancing is the method that is used to distribute the load among the different nodes. It is done in such a way that it provides good resource utilization and energy consumption. When a particular node goes down or is overloaded with the data, then load is distributed to the other idle nodes. Various load balancing and scheduling methods have been proposed. Each method has its own set of rules, restrictions and set of constraints. However, the main purpose is to develop a scheduling strategy which can achieve the goal with minimum completion and minimum execution time. To attain this optimal result right selection of the processor is to be done. Load balancers generate the mapping of tasks to data centers based on certain objectives. It employs a function that takes into account the necessary objectives to optimize a specific result. The commonly used algorithm in a cloud computing environment are related to the tasks completion time and resource utilization. The scheduler uses a specific strategy for mapping the tasks to suitable information in order to satisfy user requirements. A proper load balancing technique is required which will route the tasks based on its execution time. Computing is an event which is used for creating and designing computers operation. Computing includes all the software and hardware designing, structuring and manages them properly as the requirement of the user. We can do the computing in two ways one is parallel and second is distributed ways. In parallel computing, memory is shared between all the processors to exchange information.

A distributed computing is software systems in which components are located on different locations nodes can communicate and organize their actions by transferring messages to each other. This policy of distributed computing is completed through attaching of all computer resources together. It is under the control of software. It is scalable process which runs over the virtual server with the help of service of internet. It is considered as a next generation of highly scalable distributed computing system. It also allowed users to access their files at any computer with the help of internet from any remote sensing location. Cloud computing is a computing environment with high performance to solve larger computational problem. There are number of grids which combine together to form cluster which helps to react at the common goal. The grid cluster does not comes under the single organization. The users of grids admit all the grids as a computing source which executes the job efficiently at any resource.

A. *Maintaining the Integrity of the Specifications*

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III. TECHNIQUES TO OVERCOME LOAD IMBALANCING LOAD IMBALANCING

A. Weight Round Robin:

It is one of the improved versions of the round robin. It was proposed to solve the problem of round robin. In this algorithm, each node is assigned with weight. According to the weight assigns to the node, it will receive suitable number of requests. Depending on its processing capability, each instance of server gets the load assigned which further depends on how that instance is behaving. Weight can be allocated to every server in the gathering so that if one server is skilled of taking care of the twofold load as the other, the telling server gets a weight of 2. In such cases the IP sprayer will assign two requests to the powerful server for each request assigned to the weaker one. If the equal weights are assigned to all the nodes then same traffic will be received by each traffic.

B. *Genetic Algorithm:*

Genetic Algorithm is derived from the studies of cellular automata. It is defined by John Holland and his colleagues. It is basically a searching techniques, mostly used in the computer science. It helps to find approximate solutions for any optimization problems. In this many techniques are involved by evolutionary biology such as inheritance, mutation, natural selection, and recombination. In the representation of the genetic algorithms the fitness function is defined. The genetic algorithm proceeds to initialize the solutions randomly. It used to improve it through recursive application. In this case it involves many applications such as: mutation, crossover, and selection operators. Many Researchers have used genetic algorithms as a solution to find the better result in various fields. The genetic algorithms are used as a solution to optimization problem now started gaining popularity towards the end of the last century.

GA perform following steps to generate the optimize solution of problem:

- i. Initialization:** The population size depends on the nature of the problem, but typically contains several hundreds or thousands of possible solutions.
- ii. Selection:** During each successive generation, a proportion of the existing population is selected to breed a new generation.

iii. Genetic operators: The next step is to generate a second generation population of solutions from those selected through a combination of genetic operators: crossover (also called recombination), and mutation.

iv. Termination: This generational process is repeated until a termination condition has been reached.

IV. LITERATURE REVIEW:-

Punithasurya et al.[1] have described that when dealing with public cloud, security should be taken care. Security is very important in cloud computing. Security includes authentication, authorization and access control. In cloud storage, there are many access control schemes available. Control is the main part of cloud computing. Only access control that provides authorization to many users or authorized users. Access control has access privileges that are required by the user. Security is the major concern in cloud computing. For security purpose, Role Based Access Control (RBAC) is used. By the use of this technique time location and availability can be enhanced

J. Srinivas et al.[12] discussed that cloud computing is an adaptable innovation that can bolster a wide range of use. The minimal effort of cloud computing and its dynamic scaling is an advancement driver for little organizations, especially in the developing world. Cloud deployed Enterprise resource planning (ERP), Supply chain management applications (SCM), customer relationship management (CRM) application, medical application and mobile application can possibly achieve a large number of clients. Cloud computing has developed a well-known answer to modest and simple external IT assets. An expanding number of associations (e.g. exploration focuses, endeavors) advantage from distributed computing to have their application. This paper manages Characteristics, opportunities, issues and difficulties of cloud computing. From an innovation perspective, there are technical specialized issues to solve. From an administration or purchaser purpose of view, there are crucial usability, stability and reliability issue to solve.

Mladen A.Vouk. et al.[13] discussed that Cloud computing is a moderately recent term, which expands on many years of exploration in virtualization, circulated registering, utility processing, and more recently of systems administration, web and programming service. "Cloud computing" is a characteristic stride in the advancement of on-demand data innovation administrations and items. To a huge degree, distributed computing will be founded on virtualized assets. It suggests an administration situated construction modelling, diminished data innovation overhead for the end-client, incredible adaptability, and lessened aggregate expense of proprietorship, on-interest administrations and numerous different things.

Jerry gao. et al.[15] have discussed that Cloud computing not just changes the method for acquiring computing resources(such as computers, Infrastructure, data storage and application services)but also changes the way of managing and delivering computing services, technologies, and solutions. Cloud computing leads an opportunity in offering testing as a service (TaaS) for Software as a services (SaaS) and cloud. Further, it causes new issues, challenges and needs in software testing, particular in testing clouds and cloud-based applications. In addition, it examines the major issues, challenges, and needs in testing cloud-based software applications. Furthermore, it also summarizes and compares different commercial products and solutions supporting cloud testing as services.

Divyak. et al.[16]have discussed that the idea of cloud computing has undergone Phenomenal changes in the way how the services are conveyed to consumer. Initially Cloud provided SaaS, IaaS, PaaS to get Software, Infrastructure and platform as a service respectively, however now TaaS (Testing as a service) is rising as another conspicuous services given by cloud computing. Testing with cloud gives adaptable, versatile, scalable and pay-per-use mechanism. Testing-as-a-Service enables enterprise and consumers to save the cost of complicated maintenance and upgrade effort. Client does not have to know the physical location, configuration about the system which is delivering the service. Five important characteristics of cloud are: (a) On-demand access, (b) Scalability and Elasticity, (c) Cost Reduction, (d) Minimum management effort, and (e) Device or location independence.

AartiSingh,D. et al. [27]discussed the cloud computing attracts intention of the users due to its dynamic nature and efficient data storage techniques. The load balancing is the major issues which are raised in cloud architecture. In this paper, dynamic load balancing algorithm has been proposed which is based on three parameters CPU utilization, Memory used and fitness value. On the basis of these three parameters condition of the user is defined that whether it is normal or in critical condition. In this algorithm some migrating agents are selected on which load is migrated at the time of failure. The migrated agents are selected on the basics of their condition. This proposed algorithm works well in terms of load detection rate and load migrating time is very less. The algorithm performance degrades when all the migrating agents are in the destroy conditions.

Mahalingam, N. et al.[28]have discussed one of the critical component for efficient operation being load balancing in the cloud computing. To cater to growing demand for cloud services the cloud computing platform will dynamically configure its servers and these servers may be present physically or virtually in the computing environment. Using an appropriate load balancing approach, the virtual machine have to be selected or servers have to be scheduled. In this paper, a weighted based optimized load balancing approach is proposed for distributing of incoming jobs uniformly among

the servers or virtual machines. Further, the performance is analyzed using Cloud simulator and compared with existing Round Robin and EIPR algorithms. Simulation results have proved that the proposed algorithm has distributed the load uniformly, among virtual machines.

Chimere Barron [20] has analyzed differing issues related to cloud computing security. To guarantee cloud computing structure and to maintain a strategic distance from distinctive ambushes various security instruments have been created. To upgrade the security of cloud computing new developments has been made by the examiners. Differing sorts of ambushes like SYN surge, malware implantation, record seizing are discussed in this paper. The essential focus of this paper is on perceiving and checking SYN surge in conveyed figuring. The inventor made two computation one perceiving count and one turning away estimation. They will execute and test these calculations on cloud computing.

Soumyar. et al.[29]have explained that with latest advent of technology load balancing in cloud becomes the major challenge in cloud computing field. There are some existing algorithms which provides better job scheduling for resource allocation. It is necessary to utilize resources efficiently to gain maximum profits with optimized load balancing algorithms. In this paper various load balancing algorithms has been discussed. The objective of this paper is to identify qualitative components for simulation in cloud environment and then based on these components, execution analysis of load balancing algorithms are also presented.

Tushar D. et al.[30]have described that cloud computing is the latest trend for parallel and grid computing.It provides information, shared resources, software packages and other resources as per client requirements at specific time. As cloud computing is growing rapidly and more users are attracted towards utility computing better and fast service needs to be provided. For better management of available good load balancing techniques are required. So that loads balancing in cloud becoming more interested area of research. And through better load balancing in cloud, performance is increased and user gets better services. Here in this paper they have discussed many different load balancing techniques used to solve the issue in cloud computing environment.

Sean Carlin[31]have explained that cloud computing is the distributed architecture that centralizes the resources of server on a scalable platform which provides services on demand. Various cloud deployment models are discussed i.e. public, private and hybrid. The main security issues and risks are discussed; sharing of resources is one of them. Customers are not satisfied with the data security on cloud. Cloud service providers must tell the customers about the deployment models. They need to use the third party auditor so that they can gain the trust of customers. For this, new techniques need to be developed and older should be removed for easy work in cloud architecture.

V. PROBLEM FORMULATION

The rapid growth in Internet users and diverse services has highlighted the need for intelligent tools that can assist users and applications in delivering the required quality of services. As cloud systems gain complexity owing to increasing user needs, monitoring and adaptations are necessary to keep them fit and running. Cloud technology has become a new paradigm for distributed real-time systems because of their inherent advantages. The cloud distributed systems can reduce the load on the central authority. The central authority can distribute the task to various other mobile systems. This approach will enhance the network throughput, reduce execution time and reduce battery consumption. The network is the cloud mobile network and network's topology will change suddenly.

The approach of fault tolerance is required to reduce the number of error rates in mobile distributed network. The task allocation among the mobile nodes is done with the use of task allocation modal. In task allocation modal On the basis of capacities of processors and communication links, we allocate the tasks among processors. Failure problem can be solved by task redundancy. Task redundancy is provided by backup system that is attached with each node of the cloud distributed systems. Here, it is noted that backup system does not provide service to any tasks.

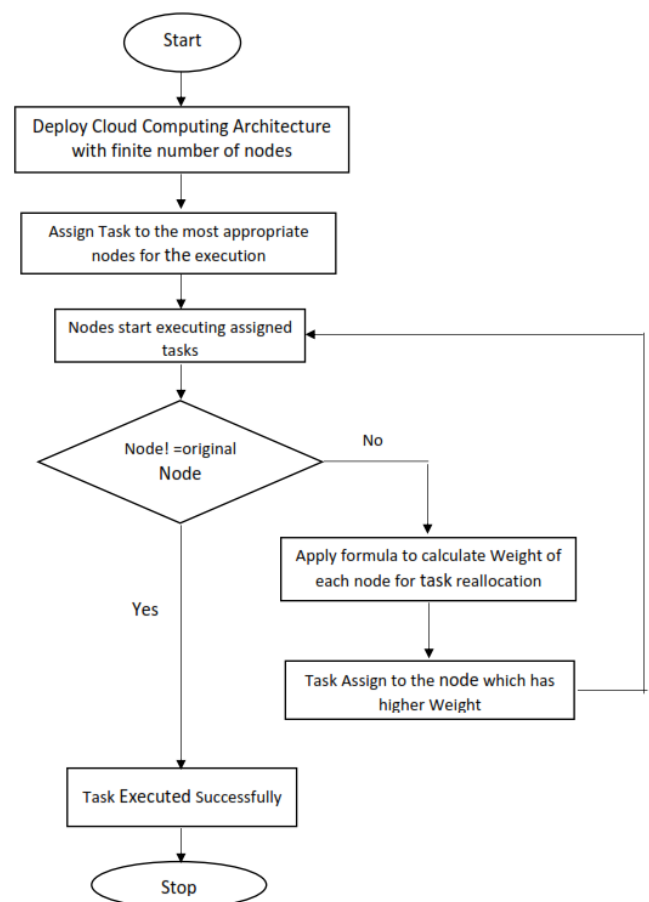
In case of node failure backup system will perform the following operations: 1) multicast a failure notice (FN) to alert the candidate nodes about the change in the number of functioning nodes; 2) reallocate all the unfinished tasks among those candidate nodes perceived to be functioning; When any node fails or when load on any node will increase, back up node will come into existence. The backup node will execute the task allocation algorithms to balance load between the available mobile nodes. In the existing modal, we need efficient task allocation algorithms and we need to define the certain parameters on the basis of which backup node will identify that on which node load is increased.

Description: The virtual machine assign task to each node in the network on the basis of failure rate and execution time. The virtual machine set some threshold value of failure rate and execution time. The node which have minimum failure rate and execution time than the threshold values are selected as the candidate nodes which are responsible for task execution. The candidate nodes are mobile nodes, due to its mobility fault may occur in the network. In this work, novel technique is proposed for task reallocation when fault is occurred on any node. The weight is the parameter which is added to the existing technique for task reallocation. The weight is the node is calculated on the basis of execution and failure rate and node which has

high weight is responsible to execute the task of the faulty node.

In this work, enhancement had been proposed for the task reallocation in cloud computing architecture. The proposed algorithm will reassign the task in case of fault when node changes its place. The objectives have been defined according to required needs for task reallocation.

In the first objective, various techniques for task allocation have been studied and more efficient technique for task allocation have been selected for task allocation. In the second objective node change its position and fault raised in the network which degrades network performance. In the third objective technique has been proposed for task reallocation to most appropriate for task execution. In the fourth and last objective proposed technique have been implemented and compared results with existing technique in terms of time and energy consumption.



Flowchart of proposed work

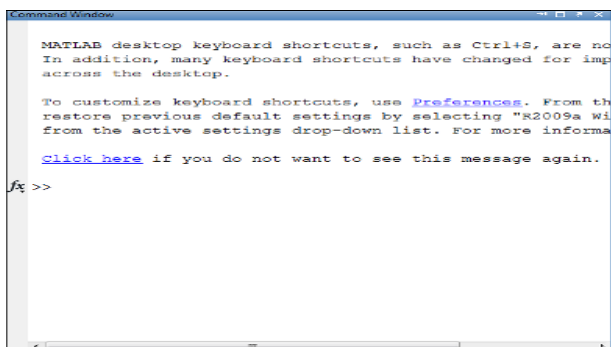
VI. RESEARCH METHODOLOGY

Tool: The name MATLAB stands for matrix laboratory. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modelling, simulation, and prototyping
- Data analysis, exploration, and visualization.
- Scientific and engineering graphics

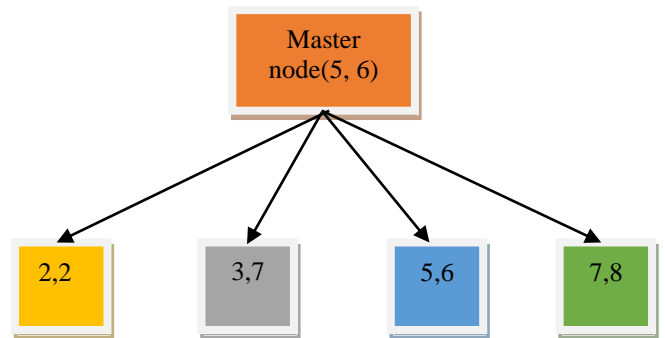
MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non-interactive language such as C or FORTRAN. MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

Command Window: Matlab commands are either executed in scripts or functions, or directly at the command window. It is often useful to test out commands you are adding to a script or function in the command window as in figure 4.1 first to ensure you have the syntax and desired behaviour right. The last typed command can be retrieved by selecting the command window and pressing the up arrow key on your keyboard. By first typing in part of the command before pressing the up arrow, only statements that began with the typed text are displayed.



In the present techniques there is one drawback that is node failure. A node failure problem occurs due to mobility of the node. In present algorithm there are number of nodes available. From these nodes candidate node will be chose on the basis of failure rate and minimum execution time. Here

Master node set threshold value which includes two parameters one is failure rate and other is maximum execution time. The nodes which have equal to and less failure rate and minimum execution time are elected as candidate nodes by the master node.



In the proposed algorithm, we have added a new parameter in the present algorithm that is master node time. Master node time is the result time to join the end users. It is for node collaboration. For this we have formulae which are as follow:

1. **E-cost= maximum execution time + Time taken by the master node (master node time)**

After that we will calculate profit of each node.

2. **Profit of each node = E-cost+ Failure node of each node.**

3. **Weight of each node=No. of tasks + maximum execution time profit**

During mobility of node, the node which has been moved from its location, the task of that node will be assigned to the node which has the highest weight. Weight will be calculated according to the above mention formulae.

Lemma 1: Load Scheduling Algorithm

Step1:

Input : Failure rate, Execution time

// enter the failue time and execution time of node

Output:: fault recovery

Step 2: for(i=0;i=number of user;i++)

{
// Range for row to column

Step 3: Assign task()

}

//for loop

Check (Execution time && failure rate)

Step 4: if (node(i)<node(i+1))

Candidate Node = Node (i)

End

End

Step 6: fault Detection()

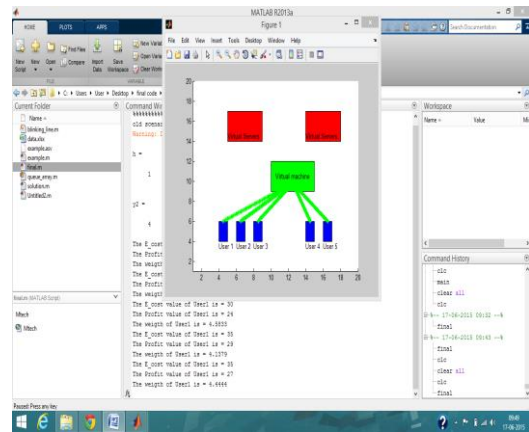
{

// calculate the fault in the node

- Step 7: if (node position!=old node position)
- // checking the node position from the vm
- Step 8: fault occurred
- Step 9: fault recovery()
- Step 10: if (weight(i)<weight(i+1))
- // calculating weight of each node
- Step 11: recovery node = node(i);
- End

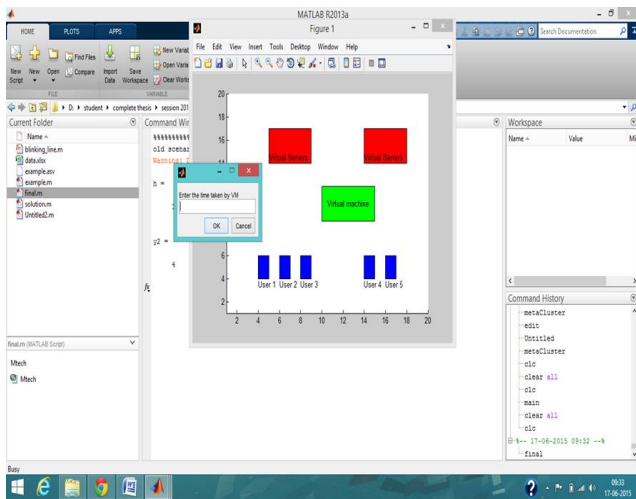
VII. RESULTS

This evaluates the performance of Genetic Algorithm, Weight Round Robin Algorithm with 4GB of RAM, 500GB of HDD, an Intel(R) Core(TM) i7 CPU, is used for conducting this research. Simulation tool MatlabR2010a is used is used for implementation.



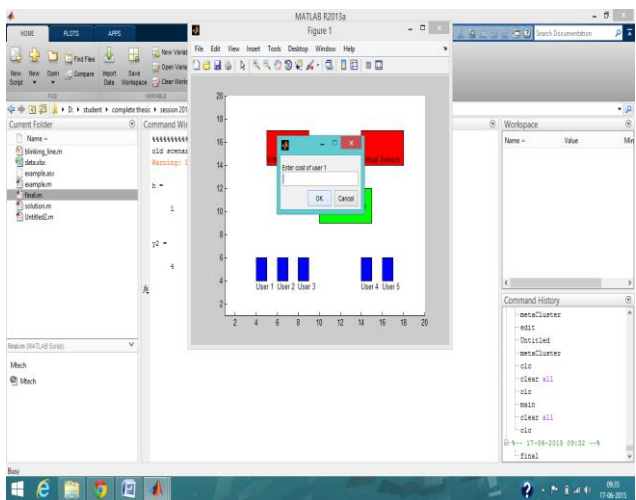
(Fig-Assign Task)

The network is formed in which available nodes are deployed, virtual servers and virtual machines are deployed. The node is asking for the time taken by the virtual machine to complete the task. The interface is asking for the cost of the user 3 to executing task which is user wants to execute. The node is asking for the time of user 3 to execute for the task which is assigned by the user. The weight of the user is calculated for the task assigned to nodes which has higher resources as set by the virtual machines.



(Fig-Default View)

As illustrated in Figure the network is formed in which available nodes are deployed, virtual servers and virtual machines are deployed. The node is asking for the time taken by the virtual machine to complete the task.



VIII. CONCLUSION

The cloud architecture have third party, virtual machine and cloud service provider to accomplish various tasks like load balancing, security and managing roles. The virtual machine is the users trust worthy machine which secure the data and assign required task to the user.

In this work, a technique has been proposed which reduces the fault detection time in the network and reduces the resource consumption to execute the allocated tasks using weight based technique. The proposed algorithm is based on the failure rate, minimum execution and time taken by the master node scheme for fault recovery and concurrent execution of processes for the process execution. This technique leads to reduce in processing time and reduce in energy consumption.

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