Maintaining the QOS Using FANN Mechanism with PSO in Cloud Computing Environment

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Abstract: We define the cloud computing as a latest computing paradigm that helps in to deliver its resources as a service, the users are free from the load of worrying about the implementation or system administrative details. There were many significant problems is exists like resources management at the time huge number of requests are coming, resource allocation, maintain the QOS in a cloud computing environment. This problem either we solved the problem at the level of deployment level, or architecture level. In this paper, we predict the future load by using FANN model. By using the previous year workload data on the Datacenters we trained that data predicts the future load in the cloud environment. The cloud provider is ready prepared to handle the huge number of requests for the resources on the Datacenters. We use FANN-PSO model to improve the QOS services, i.e. reliability, availability, Throughput, Response Time. The Prediction of Future load helps in solving the overloaded problem, minimization of VM migration, and help in improving the performances of the system.

Keywords: FANN, QOS, Learning, Prediction, Load, FANN-PSO.

1. Introduction

We know that cloud computing a pay per user base, providing the services. Cloud architecture having the three layers Saas (software as a service) that is responsible for the application service provision to the customer. PaaS (Platform as services) that is responsible to provide the platform services to the customer. IaaS (Infrastructure as a service) is responsible for providing the customer infrastructure services. This is a brief description of the cloud architecture. According to the future cloud use is increasing day by day. We need such infrastructure of cloud so that any requests has not rejected all requests are received, and also maintain the QOS services.

We need a method to find out the future load. Cloud provider is ready to handle the future load. The future load we predict by using the prediction algorithm, i.e. FANN that trained the network by using the previous year load data. After the load prediction cloud provider is doing planning how to handle that load. The cloud provider analyzes the capacity of the datacenters, server to handle the load and provide the best performances to the clients.

The First cloud provider goes on workload analyzer. Now workload analyzer goes to the Saas layer. The application provisioned that work is to allocate the resources to the customer. Workload analyzer work is to collect the information on the cloud architecture that how many requests are allocated, how much requests are waiting in a queue, and how much machine is idle.

All this information is provided to the cloud provider. Now the cloud provider is working to handle the load analysis the performances, and maintain the quality of services. In QOS are here we analysis the four parameters that are: Reliability, availability, Throughput, Response time. By this model we easily maintain the QOS of services, and because the cloud provider already knows how much load come. So planning according to that and by this model it is possible that the cloud provider receives all the requests and handle all these requests by this increase the availability and reliability to provide the services to the customer. We know

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future load so we easy to decide which request is having the low performance, and which request performances high, and how many requests are accepted capacity in architecture According to that it's managing the requests.

To improve the response time, throughput, availability, reliability we are working on the FANN-PSO (i.e. Feed forward Artificial Neural Network –Particle Swarm optimization) model. FANN-PSO is a machine learning technique. ANN having the starting is slow after that when it is trained after that it's working fast taking less time. PSO is having the searching availability is high. FANN-PSO perform mapping between the requests and resources according to their quality of services needed.

In this model we use the classifier that helps in to classify the requests. By combination of this FANN-PSO model we improve the QOS and help in to solve the challenges in a cloud computing environment.

This research paper having the following section: In section 1 being with the introduction. Section 2 presents the related work. In section 3 we described the Methodology. In section 4 gives the performance evaluation. In section 5 describe the results and discussion. Conclusions and future prospects have given in section 6.

2. Related Work

Today to maintain the quality of services is a difficult task to the cloud provider. Because due to huge number users demand for the resources are increasing day by day. So need such techniques that help in maintaining the QOS in cloud environment such techniques describe by the many researcher one techniques is exactly and fully polynomial time approximation I.e. FAPTS that describe about the QOS Aware Services. MASHUP (QASM) model, Quality of services is typically an NP-hard problem to find the optimal path for the services [1]. When some revolutionary technology is introduced than always consider the consumer requirements. Customer need best examine at the time. Many technologies are developed for the web service and their cloud computing. In the cloud computing environment to provide the best quality of service according to their customer is the main important issue, they proposed a web service for the cloud computing environment. WS-Cloud computing Framework creates their own Non functional attributes that include the reliability, Latency, Response Time, Available [2]. In Business process uses technology for their trust, increasing security in a heterogeneous are most popularity researches for their researchers today. To improve the Quality of services in a cloud computing environment by making a reliable, trusted environment for their customers and according to their Business prospective [3] [4]. The Cloud computing working on a concept pay –as-you-go and by this making cheap services are provided to their clients. Service Level Agreements are very important key aspects of maintaining the QOS, in a web services agreement (WSLA) Framework, in a cloud computing environment [5]. QOS provides the guarantee at the service level agreements that create the ability to provide the priority of users, data flow, and trusted cloud computing environment [6]. Queuing model help in maintaining the QOS and measure the performances on the cluster of services bases. Different types of Performances under measured this technology cluster services base like load corresponding, memory size, Network time delay [7]. QOS in a distributed environment in grid computing is difficult task to provide the high performances to their customers [8].

The ICT in a community help in network for sharing and the network bandwidth in a cloud computing environment. In community network, we make the prototype for the resource assignment and maintained the Quality of services [9].

In Cloud computing resources management and optimization of resources, maintain the quality of services, solve their challenges by RM techniques [10]. Virtual machine plays a very important role in maintaining the performances, fault tolerates, load balancing in cloud computing, but virtual machine also a disadvantage of cloud computing because it consumed time some time user not deal with the services because of time of migration of virtual machine [11].

The queuing model helps in to maintain the quality of services in large autonomous system and dynamic system in a cloud computing environment. To maintain the quality of service

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in case of application provisioned, monitored the performances, and provides the facility to adapt in different management system and provide the assurances the quality of service for their end users [12]. The main point is to provide profit for both the customer and cloud provider. They proposed the two sub-algorithms at different level. One at the application level and another is interaction level. Interaction level is working between the cloud providers and SaaS users [13].

An Automap technique is described to implement in a cloud computing environment by making the real cloud architecture that helps in maintaining the quality of services. In this technique its find the how much resources are needed for the user. It also describes the provisioning of multi-tier applications challenges that work is not addressed by their single tier application in a resource allocation, dynamic, flexible environment. It provides the automatic provisioning solution [14].

A study of different types of techniques and articles read and compare which provide the best result. And what problem exists related to the quality of services. There is need to find out on which parameters need to work maintaining the good quality of services [15]. Operational Research techniques and programming in mathematics play main important to learn the how to describe their problem that book provide a big scope to understand [16]. Adopt the cloud computing environment more complex in term of data management, system integration, analyzing the positive and negative points of cloud computing like costs, costs, integration, system, and quality of services [17].

Predict the load on the virtual machine to minimize the overload [18]. Therefore the main is speed up the Dc application and increase the performances with the help of implementing the concept of the caching and defragmentation. To solve the address limitations problem implemented the state diagram that is a storage model this diagram is help in extent of the hierarchical representation and implement tools that help is to recreate the I/O workload [19]. ANN-PSO model help in improving the searching speed QOS, minimization of cost, response time and improve the performances [20] [21].Every one service provider has provided a dissimilar lay down of features differentiating it beginning supplementary Clouds. This is outstanding in the way to be short of a complete structure intended for assessment of Cloud services. This is deficient in structure lead to uncertainty indecision for the end user and most users ultimately stand economic sufferers in conditions of terrible decision. In the direction of attending to this problem, need toward an all-inclusive listing of parameter addressing major performance aspects of Cloud services [22].

The Aim is to provide the services with the highest effectiveness with the least amount of cost. As there are many issues that related to providing the services cost. There need to work on providing the services in the least amount of cost, and also need to work on the scheduling techniques for solving the issues and challenges. By scheduling techniques improve the important parameters in a cloud computing environment, like reducing the response time; increase the resource utilization, during migration taking a least amount of time, providing the best quality of services in a least amount of cost [23].

For securing information needs to well-known right of entry control in a VM. Implementation using the simulator tool to develop the environment for validation and authorization to provide the future solution of the problem. The structural design level on the Software as services layer this functionality has been implemented [24].

By the QOS guarantee provide to fulfill their necessities of users demand. Currently there is no values is evaluating the cloud provider that provide their services interoperability, allocating the resources, mechanisms of resources management , and also providing their good quality of services. The superficial QOS by the users does not fulfill with the SLA agreement because, as knowing the internet environment is volatile in nature. Users need such type of cloud provider which helps in decision to provide the good QOS without failing the providing good quality of services. So for those providing the ranking based algorithm model needs help in making the decision to provide the best quality of services in volatile environment. By ranking model provide the reliability assessment to grant

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services with the help cloud provider that by comparing the hyper entropy and entropy to provide good QOS parameters previous users [25]. CMSFIC that defined as a common management services framework for Infrastructure as services in a cloud computing environment that is responsible for system importance management functions interested in layers. That structure is responsible for saving the cost and aim is to optimized use of resources by the customer. That framework is having some important feature that helps in the business field and open sources Infrastructure software as a service [26]. Needs Relative study assessment of the cloud services because of their large number of cloud technologies are available for providing the services. In present scenarios is lack of such technologies that help in comparison of cloud services. Due this lack of such technologies so there is arises a problem like uncertainty and ambiguity for their end users. For this most of the end users in the end tolerate economical losses that occur because of their bad decision taken by their end users. To solve all these need to work on the widespread list of the parameters to locate the foremost performances of the cloud services [27].

Chaos Searching Particle swarm optimization technique is used as a searching for tracking purpose. By simulation tools the result of these techniques gets good. This concept comes with the machine learning techniques so by tracking Provide the highest high power issue with small harmonics [28]. Now study the prediction techniques that are used in wireless sensor networking. That helps in minimization of the working nodes. This experiment helps in tracking the nodes to deliver the services with the help of tracking and prediction techniques [29]. The purpose of forecasting using different types, models for evaluating the real time performances. The neural network models model has, more illustrative power of forecasting the future on the basis of their previous data. In neural network models, analyze on their two stages, first on the static and dynamic [30].

At above study all this research paper, we analyze that is lack of such machine learning techniques in a cloud computing environment to maintain the quality of services.

3. Methodology

Cloud computing manages the resources are important because of the load is increasing day by day. Cloud provider have need to aware future load coming in, the datacenters. The cloud provider having planned to how to handle the upcoming future loads. By this planning that it provides the best quality of services, and handle the issues like that overloaded problem on the server, minimized the VM migration, and increase the ratio of accepting the request. We are working on that load prediction algorithm and find out the method how to provide the best quality of services. We use the machine learning technique. For the load prediction we use the feed forward artificial neural network (FANN) model. FANN designing describe as one input layer, two hidden layers, one output layer. In input layer we use the five neurons, in the first hidden layer we using the five neurons, in the second hidden layer we using the ten neurons, and then output layer we use one neuron. That transfer sigmoid function helps in to train the network as well as help in to achieve the target. We use the supervised learning algorithm. That is an adaptive algorithm helps in improving the result of the observation. In this algorithm we know the data and the response, so that the model helps predict in providing the support in the presence of ambiguity.

For load prediction we need the previous year load data of the request coming to the datacenter, that data is collected from the website [22]. Later than that, we normalize the previous year load data. By using the formula

$$D' = [(D - \min)/(\max - \min)]$$

Where,

min = is the maximum value along the particular column,

max= is the maximum value along the particular column,

D= is the original value.

D'=is the normalized value.

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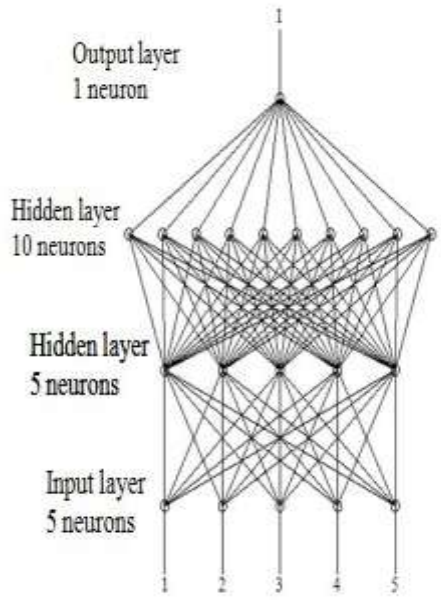

Fig.3a. FANN load prediction model

We are now making the three sets of data for the training sets, testing sets, validation sets. Once the model is ready, we first perform the training phase that is called the learning phase. In this phase the supervised algorithm help in to learn the neurons help in minimized the error during training. When the neurons trained after that we enter in validation phase. Validation phase, we check the data that are not trained during the training phase of determining the performances of FANN. Once the validation phase is completed, after that we enter in testing phase. In this phase, we check the overall performances of the FANN. If the learning phase is stopped by having the minimum sets of error in the validation phase than we can say that it give the best answer.

When that predicts the model predict the load, now that the load is sent to the cloud provider. Now cloud provider is aware of the future load of the request on the datacenter. Now the Workload analyzer is analyze the whole architecture and find out the capacity to handle the future load of the requests, analyzed the performances of the machine in real time, and find out how many machines in ideal state and how much requests in waiting in a queue, how many requests are assigned to the resources, how much requests are departing from the queue. Once the whole architecture analyzed cloud provider is doing planning to handle the future load. For improving the searching ability and maintain the QOS we implemented the FANN-PSO model, that help to solve the arising issues after the load prediction. First the clients are sending the requests to the cloud provider. Now cloud provider has classifies the requests into the three clusters that is based on the QOS. These clusters are sent to the Feed forward Artificial Neural Network with Particle Swarm optimization model (FANN-PSO) that help in improving the searching ability and perform the mapping of resources to the requests according to QOS of services needed. For the designing of FANN-PSO model using the three layer input layer, hidden layer, and the output layer. On the input layer we give cluster as input, on the hidden layer we using the PSO algorithm that finds out the best fitness value means best resources so that perform the mapping between the resources and requests according to their quality of services. FANN-PSO helps in solving the issues and challenges in a heterogeneous cloud computing environment, and helps in to improve the quality of services.

Algorithm

1. Initialize the I=1
2. Collects the previous year load data, normalized the previous year load data, and divided into the equal sets, i.e. Training sets, validation sets, testing sets.
3. We first perform the training test in this test first; we have given training sets as an input in the FANN model to train the neurons.
4. Now that the input process between the inputs and hidden and then output layer.
5. We compare the result to the Target and calculate the error, then back propagate that error to the input layer.
6. Repeated the step 5 till it didn't match to the target and set up their weights and bias value.
7. I=I+1, Now we perform validation and testing phase and predict the load.
8. The Future load percentage is sent to their cloud provider now the cloud provider goes to the workload analyzer that working as a monitor.
9. Workload Analyzer calculates the percentages of the idle machine, how much machine are allocated for the request, and how much

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machine are free, how much depart. That information provided in the cloud providers. Cloud provide also analyze the real time performance of the server.

10. Now the cloud provider collects information and planning to handle the future load.
11. Now if the client request is coming to the cloud provider, it classifies the requests with the help of the classifier.
12. Now the classifier classifies the requests send to the FANN-PSO model
13. Now FANN-PSO is assigning the resources to the requests.
14. The output provides a good QOS of services in a dynamic and heterogeneous cloud computing environment.

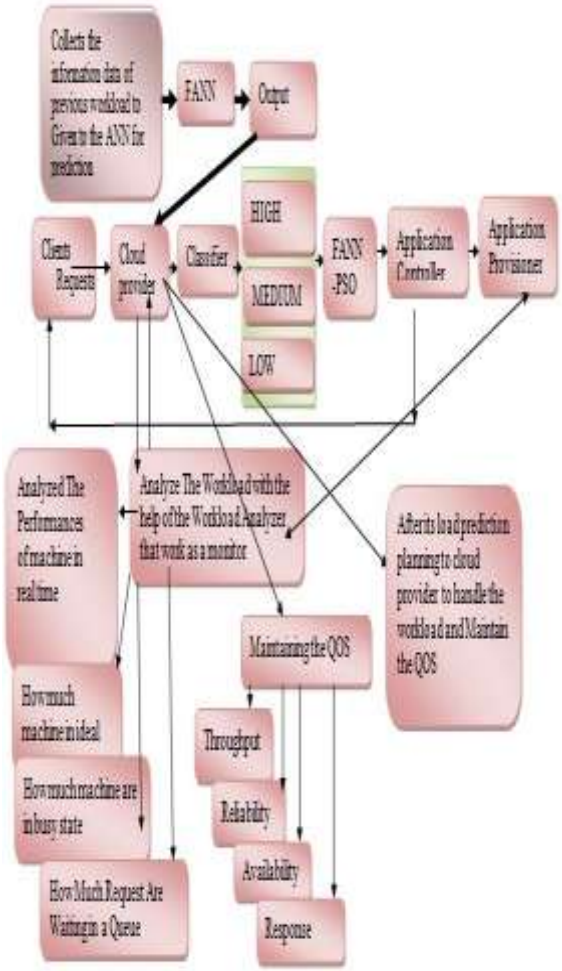

Fig.3b. System Model for the load prediction and maintain the QOS

4. Performances Evaluation

After the load prediction the cloud provider working on the performances and measure the quality of services to assigning the requests to the clients. In this model of performance evaluation, we measure the cost, measuring the quality of services, and find out the how much machine are in an ideal state

4.1. Cost Performances Measurement

Here we use the two costs one of the resources offering for the request, and second cost of delay to provide the resources.

Total cost = resources offering cost+ cost of delay to provide the resources.

Cost of delay to provide the resources= $W*P_s$

W=waiting per unit time for the request.

Here P_s are derived to by the probability of Marko chain analysis:

$$P_1 = \zeta * S(t) + \frac{\zeta^2 (S^2[t] + \text{var } y \ \ services\ time)}{2(1 - S[t])}$$

$\zeta\ value\ is$ Less than the service time. Here we taking the ζ value is 0.5

$S^2[t]$ is the service time.

4.2. Idleness percentage

Calculate the idleness percentage we using the formula

$$I = \frac{number\ of\ \ server - (P_1 - P_2)}{number\ \ of\ \ server} * 100$$

P_2 is the performance parameter is calculated as:

$$P_2 = P_1 - \{\frac{number\ of\ \ requests}{services\ time}\}$$

P_1, P_2 are the performance parameters.

4.3. A Percentage measure of the number of requests arrival

$$A_1(t) = 1 - (1 - e^{-\zeta t})$$

$$A_N(t) = \frac{(\zeta t)^n e^{-\zeta t}}{n!}$$

$$A_1(t) = arrival\ rate$$

$$\zeta = \text{int}er \quad arrival \quad time \quad less \quad than \quad the \ services \ \ time$$

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n=0, 1, 2, 3……

4.4. A Percentage measure of the number of requests departing

$$D_1(t) = 1 - \sum_{n-1}^{N} D_N$$

$$D_n(t) = \frac{(\zeta t)^{N-n} e^{-\zeta t}}{(N-n)!}$$

n=0, 1, 2, 3, 4……

5. Results and discussion

Our model is to predict the future load so that it is ready to handle the large number of requests is coming from the clients. We are working on predicts algorithm using FANN that is working to feed forward Artificial Neural Network. In this model we first predict the future workload of the request for the resources. For the Prediction we use a Feed forward Artificial Neural network of the trained the previous workload information, that information data we have taken from the website [22]. We use the sigmoid transfer function that is nonlinear in nature; we have division the previous workflow information into three parts for testing, learning, and validation. When the load is predicted it sends to the cloud provider. The Result comes from our model is maintained the quality of services in a cloud computing environment. QOS include the five parameters reliable, availability, throughput, response time. And also solve the many issues and problem Cloud provider knows in advance how much load come, to handle the load it has collected all the information like that, how much queuing size, how much its service the request, how much depart the request, how much machine in idle State. For finding all those things we derived their formula in our paper. The cloud provider receives all the information on cloud architecture, it manages the requests and allocated to resources to the request, also finally analyzing the performances in a cloud computing environment. The Feed forward Artificial Neural Network is designed architecture described as one input layer, one or more hidden layer, and one output layer. Five neurons are taking on the input layer. We use the two hidden layers on the first hidden layers we using the five neurons. On the second hidden layer we used the 10 neurons. On the output layer we use the one neuron that predicts the future load. After that we divide the data and making the three sets first sets is testing sets, prediction sets, validation sets. After that we normalize the data.

Table 1. Normalization of workload data

Input 1 (141270000.00000 ~ 191970000.00000)	200000000
Input 2 (0.00000 ~ 245760000.00000)	250000000
Input 3 (140520000.00000 ~ 196320000.00000)	200000000
Input 4 (0.00000 ~ 176670000.00000)	200000000
Input 5 (136890000.00000 ~ 184980000.00000)	200000000
Output 1 (137370000.00000 ~ 171270000.00000)	200000000

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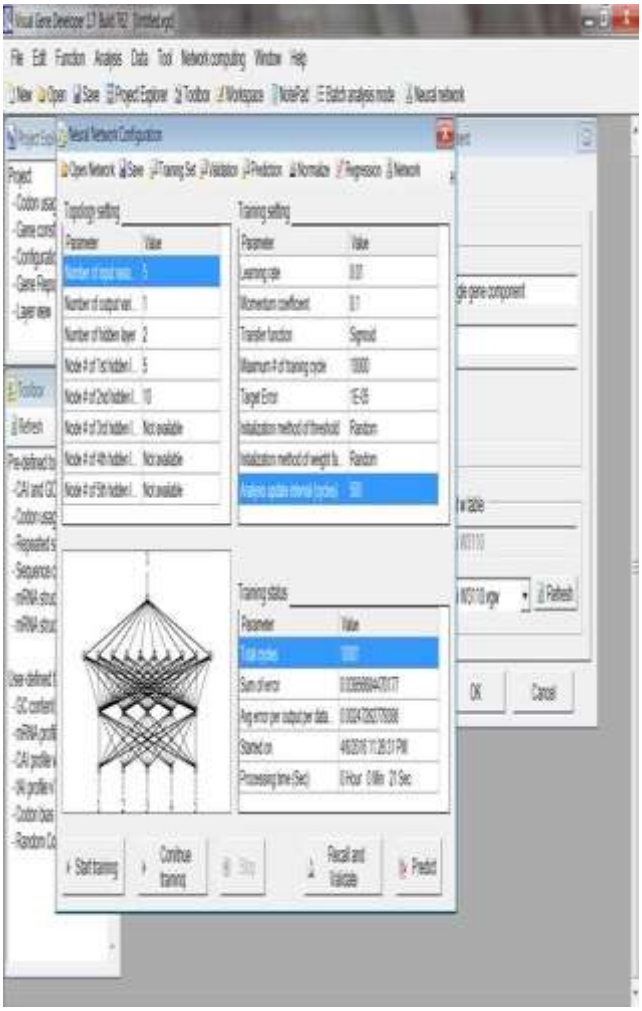

Fig. 5a. Visual Gene Developer simulation tool

Now we train the workload information by using the feed forward Artificial neural network i.e. MLP structure. We have to remember also for selecting the workload information is not so less any sets training sets, testing sets, validating sets.

If we have taken the less workload information so finding the correct result is a difficult task. To

Train the workload information aim is to find the set of weight values that will cause the output from the ANN to match to the target values as closely as possible. There several issues are arising when we train the neural network. First is selecting the number of hidden layer and neurons how much are used on the hidden layer. Second is to avoid the local minima and finding the globally optimal solution. For the learning state we use the supervised learning algorithm. In learning state adjusted the bias and weight value to reach near to the targets. In ANN prediction model we use sigmoid transfer function. For feed forward ANN design we use the Visual gene Developer 1.7 simulator tool to predict the future load

5.1. Feed forward ANN Model Load prediction

First, we perform on the training phase, that phase is called the learning phase. In this graph the testing phase predicts the load is 74% of the request on the cloud computing environment. After that now we perform the testing phase, in these phases, we compare the training phase and testing phase result i.e. 74%. Now the third phase is called the validation phase in this phase, validate the output that come is 74%. So now we finally can say that future load is 74%... The validating test is a practical and reliable test that has the predicting power. It helps in reducing the error. Validation can we use the three ways: to estimating the performance, and helps in model selection, and helps in adjusting the learning parameters.

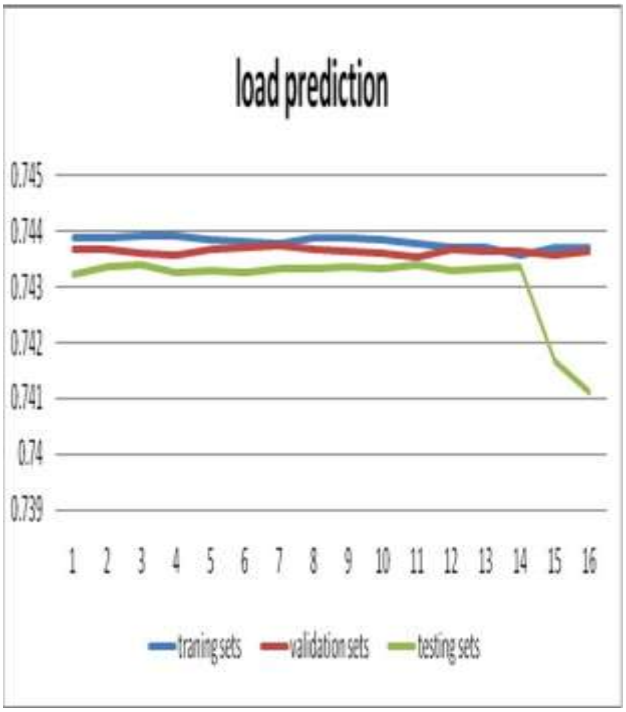

Fig. 5b. Load Prediction Graph

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5.2 Regression testing

Table 2. Regression analysis

Training	Out1	18.82877	0.0009807192
Validation	Out1	0.0113334	0.0002181422

5.2.1. For the training sets regression testing

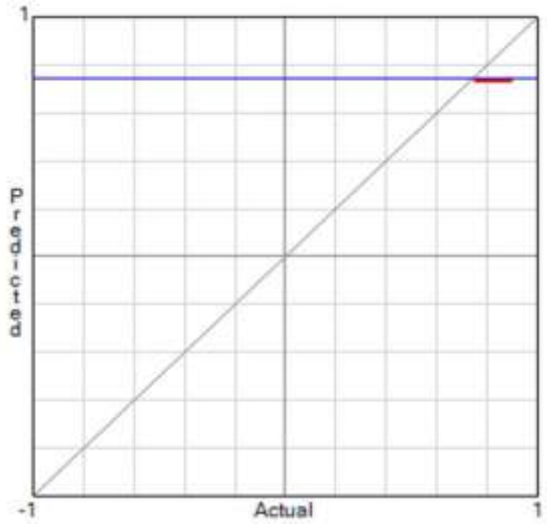

Fig. 5c. Training Regression Testing

5.2.2. For the validation sets

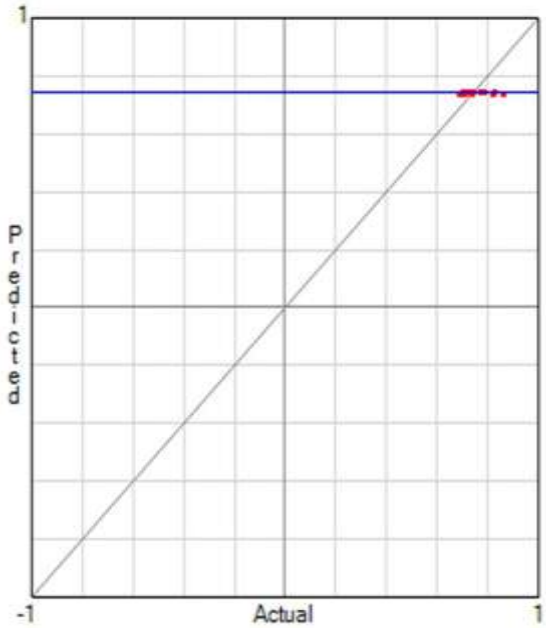

Fig. 5d. Validation regression testing

In regression testing we analysis the accurate result of the load prediction for this we first perform the testing test and after that we perform the validation test. The validating test is a practical and reliable test that has the predicting power. It helps in reducing the error. Validation can we use the three ways: to estimating the performance, and helps in model selection, and helps in adjusting the learning parameters. The load prediction result is 74% that information is sent to the cloud provider. Now the cloud provider first analyzes the workload. With the help of the analyzer is analyzing the workload and performances of the system or the capacity of the cloud system to handle the upcoming future load. Cloud provider doing planning according to load prediction to handle the upcoming future load. Our main aim is to provide the QOS, minimization of VM migration, reduces the power consumption by the planning.

5.3. Measurement of performances after load prediction

Here the performances after the load prediction. When the predicting load is high, then the performances degraded. To handle the such problem cloud provider has been already to know how much load are coming by using previous year data prediction it ready to handle the load. For improving the performances and QOS in a cloud computing environment, we use FANN-PSO model that help in improving the QOS in a cloud computing environment.

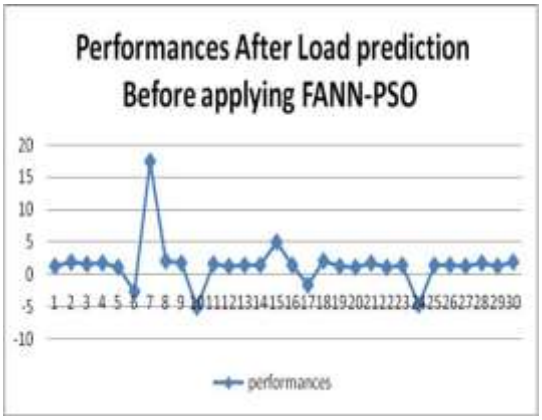

Fig. 5e. Measurement of performance after load prediction before applying FANN-PSO model technique

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5.4. Improve the Performances after a load prediction by FANN-PSO Model

In starting it is in learning state after that when it is learn it performances is increasing. So that we say that FANN-PSO model help to maintain the Quality of services. For Improve performances 20 to100 vary.

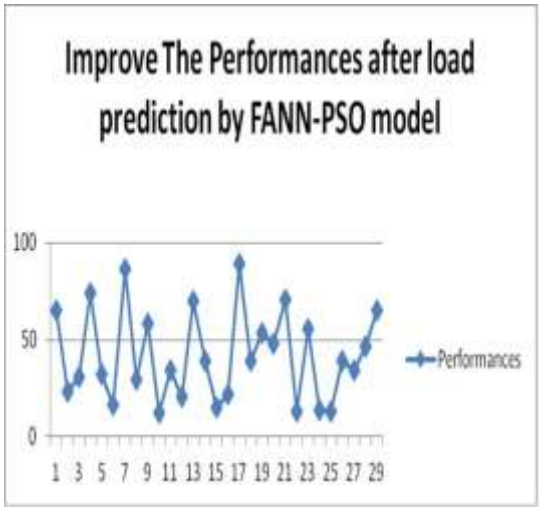

Fig .5f. Improve the Performances after a load prediction by ANN-PSO model

5.5. Analysis Speed over the FANN-PSO Model

After the load is given to the FANN-PSO model measure the speed at different time interval. Provide faster response to the request and improve the QOS.

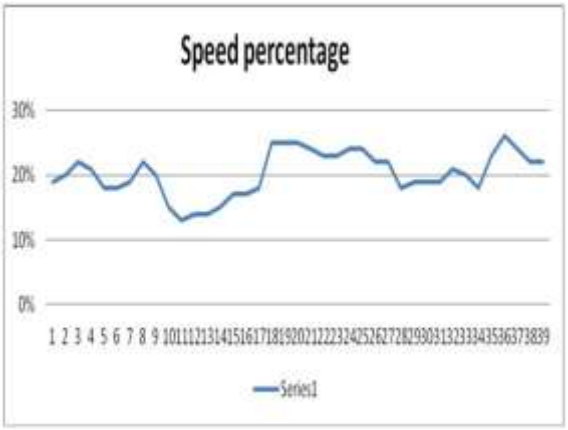

Fig. 5g. Analysis Speed over the ANN-PSO model

5.6. Different types of cost

Here we show that total execution cost that little greater in comparing to transfer cost.
The total cost is calculated as the total execution cost and total transfer cost.

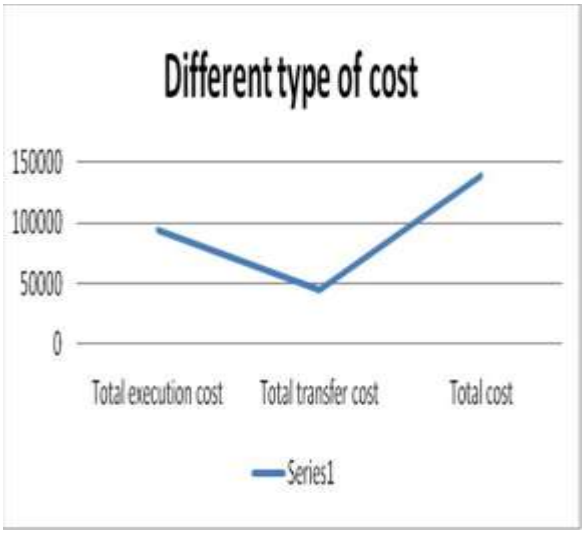

Fig. 5h. Different Type of cost

5.7. FANN-PSO Model Response Time

Here we show the result of the response time by using the FANN-PSO model. In this we show the packet sending time and packet receiving time on the number of tasks performed.

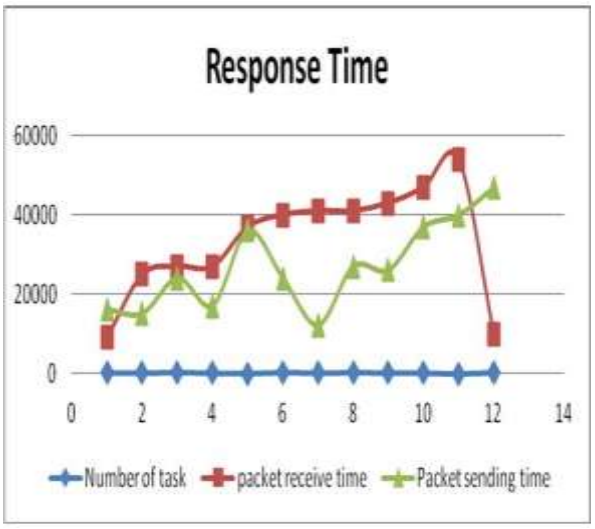

Fig. 5i. FANN-PSO model response time

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6. Conclusions and Future Prospective

Cloud computing is a new technology that is rapidly growing in IT industry. To maintain the requests and QOS in a cloud computing environment is big challenges due to comes the huge load of the requests. We are working on these fields and applying the technique for maintaining the quality of services. We use the FANN load prediction model to maintain the quality of services in a cloud computing environment. That helps the cloud provider to find out how to handle the huge number of requests. By analysis the cloud architecture, and finding out the number of requests in a queue, and how many requests are in services, how much machines in idle state, how much loads of the request come how much capacity to allocate. So, all this information is already now the cloud provider to ready to handle. To improve the QOS services and performances we use the FANN-PSO model. FANN-PSO help improving the searching ability of the resources according to their quality of services, response time and best performances of the system, help in minimization of cost, and provide the best QOS. By this provides the best performances for the each request. By this model we handle load balancing, fault tolerance, minimize the VM migration, etc. Our main motive to provide a good QOS to the clients in cloud computing. In future prospective we can improve the model and create intelligence in the model so that it automatically able to handle all those issues and challenges and minimization of VM migration, and improve the performances of services, reduces the cost and power consumption less. It is profitable for both clients as well as the provider.

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