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Research Paper

Web Service Monitoring Scheduler based on evaluated QoS in Dynamic–Environment

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ABSTRACT:- *The value of quality parameters plays an important role in the customer's decision making when choosing a service. Monitoring of the parameters is carried out for achieving accurate and actual values of parameters. Because of monitoring carried out in every service callout, an overhead on the web service could be seen so that the values of the parameters may be adversely affected by the overhead too.*
This study proposes a method to prevent monitoring the parameters in every service callout. In this method, the values of parameters as time series are assigned to forecasting components in such a way that these components use time series forecasting methods to estimate the future values of the parameters based on their past behaviors.
In this case, there will be no longer a need to monitor the future values of the parameters in every system callout, thus eliminating the prevalent overheads in any monitoring carried out. Using this method, the more optimal and beneficial quality parameters also could be obtained.
To schedule and predict the monitoring, a neuro - fuzzy network having an intelligent behavior, high capability and more flexibility than other methods will be used. In addition, MATLAB software is used for simulation, thus the prediction is performed by the best network and its parameters.

Keywords:- *adaptive neuro- fuzzy inference system, neural network, monitoring, quality of service, web service*

I. INTRODUCTION

Service Oriented Architecture provides a reliable approach for the next generation software platform. Every day we are faced with increasing service-based systems which will increase the services with similar functional capabilities. In these conditions, attention shave attracted from operating characteristics or non-operating characteristics (quality), whereas the latter have played an important role in the selection ,discovery ,and composition of services.

Service providers use quality parameters as a way to compete in the market. In this way, customers could select the best service among several services with the same operating functions based on the i quality requirements. When a customer selects a service, a contract is concluded between the customer and the service provider. Will the service provider provide the agreed quality of service? The only way to answer this question is of monitoring the quality parameters [1].

Monitoring of quality parameters is a part of the service level agreement (SLA)management process. By monitoring and obtaining actual values of quality parameters, the customer and service provider are aware of the actual level of service quality. Based on the service level received, the costumer decides whether to continue or discontinue cooperation with service provider. Therefore, monitoring of quality parameters plays an important role in the survival of cooperation of customer with the service provider, whereas the customer decides based on the accurate values of parameters. Monitoring parameters are also looking for ways to achieve accurate values of quality parameters.

Therefore, monitoring of quality parameters is inevitable and one of the fact or attracting customer's satisfaction [2]. The only important key is the overhead resulted from the monitoring process, since the system is being heavy once a service is called, due to taking place the monitoring process. Moreover, the activities of monitoring system may lead to create messages in the system and to involve system resources. The Overhead induced by monitoring may impose negative effects on the valuesof the quality parameters[3,4].

In this study, section 2 will review related works in this field ,The concept of monitoring web services and prediction of series times will be studied in section 3. In the next section, i.e. section 4, we attempt to provide a

solution for scheduling and monitoring of Web services in service-oriented architecture based on the predicted values of quality parameters. This will be carried out in order *to* prevent overhead in the service oriented architecture that reduces the system performance and finally the proposed method will be evaluated in section 5.

II. RELATED WORKS

The term monitoring has been widely used for the design and engineering service-oriented systems. In the life cycle of a system, only the monitoring process plays generally the role of an information collector. The monitoring may be defined as: "the process of collecting and reporting appropriate information about the implementation and development of services in service oriented architecture" [5].

What is monitored? The operational or non-operational parameters or both ?In what form is this done? Is monitoring performed each time during the implementation of the services and the information is presented? Or after a period of implementation of service is passed, a summary of information is presented?

- The quality parameters that determine the quality characteristics of the system are monitored such as accessibility, performance, reliability, etc.
- The quantitative analysis of these parameters is considered; in each run time , this is done for service to determine the weight of the quality parameters to the customer at any time during the run. So, knowing the conditions, costumers could readily decide according to their interests [6,7].

2.1 Mechanisms of monitoring of quality parameters

Monitoring of quality parameters of web services is usually performed by a variety of mechanisms, each claiming to be the best (most accurate) to perform monitoring. In each mechanism, the quality parameters are measured based on a quality model. Mechanism of monitoring can be in the levels of service, the communication or coordinator. According to methods used for monitoring quality parameters, the client or server or a third party, such as BUS is selected to perform monitoring.

2.1.1 Monitoring approaches

The first approach is the service level monitoring which is the most fundamental approach in monitoring of quality parameters. In this approach , the monitor code is entered in client code and the Web services provider; for example, putting a timer on the client code to record the time of request and its receiving, or by encapsulating the operational functions of the client/provider of web services that are inspired by aspect-oriented architecture. The second approach is monitoring of quality parameters in the communication level monitoring. In this approach, monitoring is performed through interpreting the messages exchanged between customers and providers of web services. The messages are exchanged in Web services by SOAP, HTTP, TCP / IP protocols. In this method, by analyzing the messages exchanged through the communication level, attempts are made to collect data on quality parameters and thus the quality parameters of a Web service are obtained.

The third approach is monitoring of quality parameters in Orchestration Level Monitoring. In this approach, monitoring of quality parameters is performed on BPEL services using aspect-oriented programming.

2.1.2 Monitoring of quality parameters at different locations

The first place to do the monitoring is monitoring of quality parameters on the client side. This is done by means of additive tools on the client side. One of the tools for this procedure is Webinject tools. Webinject is a tool on the client side which calculates the actual response time of web services through sending requests of web services and analyzing the response time. Also, it estimates there liability by computing the number of successful and un successful requests. In this device, three parameters including response time, reliability and security will be examined. The tool is written in Perl programming language and is compatible with all environments [8]. The second place for monitoring is on the server side. Sandact tool is one of the tools available in this area. This tool can monitor websites and web services. In this method, monitoring is done on the server side, so that the server calculates the actual valuesof quality parameters by recording the times of sending and receiving requests, and counting successful and un successful responses to the client. This method of monitoring of quality parameters on the client side has more interests. Among the other tools in this field is Soapknox Software[9]. The third place for carrying out monitoring is monitoring of the quality parameters on the third party side such is BUS. This method is the most popular solution for monitoring. Monitoring is often done in BUS and by using the components , so that the BUS monitoring components tries to collect data and calculate the true value of quality parameters. In this study, we will attempt to achieve an optimized and more useful method for monitoring quality parameters[10].

III. MONITORING OF QUALITY PARAMETERS

The increasing progress of service-oriented architecture in the field of information technology will discuss new requirements .With the increasing of web services with similar operational functions, customers and

service providers are shifting their attention or non-operational (quality) functions. To use the web service, the client and service provider should agree on the values of parameters and conclude a contract. Therefore, monitoring of quality parameters is essential. The costumer should know what quality he/she receives a service with. Obtaining the values of quality parameters enables the customer to apply the considered punishment to providers in the case of violation of the contract sections. In these conditions, by investigating the current approaches of monitoring of quality parameters it may be concluded that, these methods reduce the system performance efficiency by imposing an over head on the system and the quality parameters maybe negatively affected.

One way to reduce system overhead is to use of scheduling approach of monitoring of quality parameters by a prediction method. In this case, it is not necessary to monitor the quality parameters at each service call. The scheduler is responsible for the monitoring management. Here, the monitoring time is determined primarily by the scheduler; then quality parameters are estimated by calling the run command using the prediction components. In the prediction, based on past behavior of a parameter, its future behavior is predicted. Prediction approaches analyze the past behavior of parameters using a variety of techniques, and predict the future performance based on the performed analyses. Using the scheduler, the most reliable and the best value is selected. By investigating the realized quality, the user is informed from the process of implementing a web service intended.

The values of each quality parameter form a time series, where as the future valuesof time series could be predicted by using a number of prediction methods. In this study, we intend to predict the time series using the two predictive components of neural networks and neuro-fuzzy.

❖ **Time series**

A time series is formed of arranged data of a variable. The data were measured at regular intervals in order , and they can have their own patterns. Time series can be divided into two parts : continuous series, a series in which observations are produced continuously in time(even if the values are discrete); and discrete series, a series in which observations are occurred at certain times usually at equal intervals [11].

❖ **Time Series Predictions**

The prediction of time series is taking data of Xt-1, Xt-2, ...,X t-n to predict data of X t +1, X t +2. Time series prediction methods are sought to predicted values that has not happened yet. Predictions are made based on analyzing the past behavior of time series .Today, knowing the possible future trends of a system is considered a great advantage for us. For this reason , researchers are trying to provide the best method for time series predictions, and every day newer and better ways to achieve a more accurate prediction of time series are being presented.

Various methods have been presented to predict time series which are based on two statistical and intelligent approaches trying to predict the future trend of a system. These are 40-year-old methods that took a new strength by development of intelligent methods in the 90's. Today, the time series prediction methods which use intelligent approaches such as neural networks and neuro-fuzzy, are more popular than the other methods .All these methods are trying to provide the most accurate predictions about the possible future behavior of a time series, through analyzing its past behavior correctly [12].

Among the methods that have been used in this area are:

- Decision tree
- Estimating tree
- Genetic Algorithms and Evolutionary Algorithms
- Vector estimation
- Statistical Methods
- Neural networks and neuro-fuzzy

In the proposed method, neural networks and neuro-fuzzy that are most useful in predicting time series are used. Time series prediction using neural networks and neuro-fuzzy is the biggest competitor of the other methods and has attracted much attention of researchers due to the ability of these systems [13].

IV. PROPOSED METHOD

4.1 Monitoring of quality parameters by scheduler using time series predictions

As mentioned earlier, in order to achieve lower overhead for service-oriented architecture, one way is to use scheduling approach. In this approach, using a scheduler, the time required for monitoring process is determined and the values of future quality parameters are estimated using prediction methods. The best reliable parameters are then re-selected by the scheduler for their quality check. The selected components are used to perform monitoring for the subsequent periods. Thus ,we see that the numbers of monitoring performed at each

service call are reduced and we are close to our major goal of reducing the overhead of service oriented architecture. Using scheduling approach for monitoring of quality parameters, optimized and more useful service-oriented architecture is obtained[14,15].

Here, the proposed method of monitoring based on scheduler and the prediction method is explained.

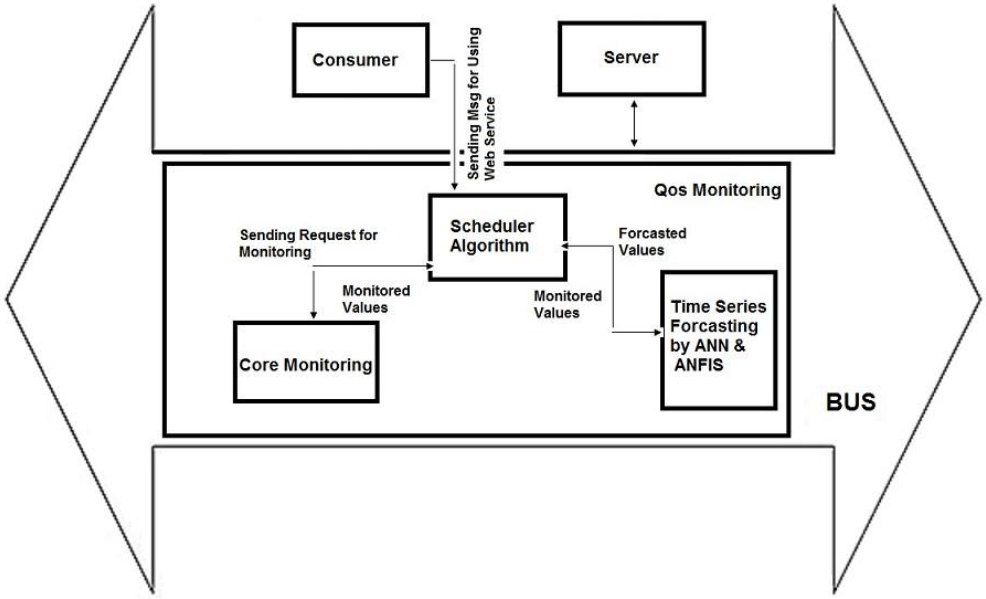

Fig 1: Monitoring of quality parameters by scheduler using time series predictions by neural net works and neuro–fuzzy

As it may be seen in the above figure, when the user starts using a service, he announces the scheduler the start the message, also sends the service level agreements to the scheduler. Thus, the scheduler according to the user's messaging and by investigating the applied web services, gives the command to start monitoring to the monitoring component. The monitoring component performs monitoring of quality parameters using the available conventional approaches .Today, procedures of monitoring of quality parameters that are performed in the service level and in a third place, such as BUS, are more popular. Thus, the values of quality parameters are measured according to the conventional methods. Measured values are sent to the scheduler and in this case, the scheduler sends the received valuesto the predicted components.

Component of the neural network prediction and neural networks-fuzzy teach their own algorithm with received data. They find and predict the future behavior of a quality parameter by analyzing its past behavior. The scheduler will select the most accurate model as the best model ,according to the amount of future values and the precision and mean square error of the two methods .Then, by considering the accuracy and mean square error for the prediction ,the validity of data will be checked and the data will be compared with the service level agreement. If the service quality is low, it will notice to the user that the service quality is lesser than the agreement. However, if the both prediction models fail to reach the agreed accuracy and error level, we will continue to use monitoring components for obtaining the values of quality parameters.

4.2 Scheduling algorithm

1 ***begin***
2 *Accuracy = Accepted value in QoS contract*
3 *MSE = Accepted value in QoS contract*
4 *Accuracy's Tolerated Value = Acc/10*
5 *MSE's Tolerated Value = MSE/10*
6 *User select the web service for using*
7 *User send PM to scheduler// User says to scheduler: I am using the web service x.+ service level agreement*
8 *Scheduler starts operations*
9 ***loop***
10 *On_New_Monitoring (ET_m,…, ET_{i-1},ET_i);// based on scheduler's decision*
11 *On_New_Prediction (ET_i , ET_{i+1},…, ET_n);// predicting new value by ANN and ANFIS*
12 *Calculate ANN's Accuracy and ANFIS's Accuracy // by scheduler*

13 Calculate ANN's MSE and ANFIS's MSE// by scheduler
14 Select the better Accuracy and MSE then the best = Prediction's Algorithm// by scheduler
15 ***if*** *(Prediction's Algorithm Accuracy >= Acc) and (Prediction's Algorithm MSE <= MSE + MSE's Tolerated Value) then*
16 using predicted value as real QoS value by schedule // after that scheduler compare predicted value with Service Level Agreement. It means predicted values are as real value. If predicted values are less that Service Level Agreement parameters, scheduler send alert to user
(predicted value + monitored value compare to SLA. If predicted value + monitored value < SLA value then send alert to user.)
17 ***else*** *(Prediction's Algorithm Accuracy <= Acc + Accuracy's Tolerated Value) and (Prediction's Algorithm MSE >= MSE)*
18 ignoring prediction approach;
19 ***end loop***

4.3 Scenario of scheduling algorithm

In this algorithm, first ,the accuracy parameter and the mean square error are initialized in order to evaluate the validity the predicted values and their tolerances (deviations). Then according to the user's request to use a web service and its notification to the scheduler, the duty of scheduler component begins. Scheduler component inside a loop, first, gives the command to start monitoring to the monitoring component. The monitoring component measures quality parameters based on the conventional methods. The neural network prediction and the neural-fuzzy network components receive data to create a prediction model and estimate the future values of parameters; they sent the estimated values to the scheduler.

After this step, the accuracy and the mean square error of the prediction models will be evaluated by the Scheduler, and the best prediction model is chosen between the neural logical and neuro-fuzzy models. The selection criteria are the amount of error and mean square error of the two models; the model with a higher accuracy and a smaller mean square error will be selected as the most reliable model by the scheduler. The performance the neural logical and neuro-fuzzy models depends on type of the time-series. In a time series, the neural network may produce a better model, while in another time series, the neuro-fuzzy model may produce a better model. This section is aimed to select the best model as the prediction model for applying in the subsequent steps.

Atthend of the loop, the predicted value is to be accepted or rejected using a conditional statement. In this section a condition is applied. If the accuracy of the prediction model is greater than or equal to the agreed accuracy (in Part I) and the mean square error of the prediction model is lesser than that of the agreed one(in Part I), in these conditions , the predicted valueswill be valid andcan be considered as acceptable values of quality parameter by the scheduler . In the second part of this step, based on the values obtained, the scheduler decides on the service level agreement conditions; if the quality of these values and that of the monitored values are lesser than those mentioned in the service level agreements, the user will be informed. One advantage of this method is that, if the quality of the web service is being down to the crash point, this will be revealed prior to the web service loss. Thus, the user will be informed before the event is occurred to change the web service. In this way, the user may change the web service before it is stopped. So, using this approach, before performance loss of a web service, another web service is used and the user will not see the web service breakdown.

In the last part of this step, if the conditional statement is not hold, the values obtained by the prediction model will be neglected and the monitoring component will be considered as the source values of quality parameters yet.

4.4 Scenario of predictions component

To predict the quality parameters by neural networks and neuro -fuzzy models, the present values of the quality parameters are sent to the predictor component. The predictor component divides the data into two training and test sets , and then the network is trained by means of training set. During the training period, the desired output error and the actual output error are measured. The goal of the training phase is to reduce the error by means of weight adjustments. Therefore , during training ,the error should be reduced. The training will stop when the error is negligible.

Finally, using the test set, the predictionability of the network is measured. If the network did not work on the testing set as well as on the training set, it would be located on the extra training data. This problem is referred to be as over fitting. It means that, after the network training, error on the training set reaches its minimum value. However, by providing new data to the network as input data, the error increases significantly. In fact, the training data is completely surrounded by the network, but the network cannot respond appropriately in the face of new data. The predictor component begins to train its own algorithm using the transmitting data.

After reaching desired conditions, the training will be stopped and component predicts the future values of quality parameters.

The desired conditions may be the specified error. After reaching the optimum conditions by the predictor component, the values of quality parameters are produced. Hence, it may be concluded that the aim of the component is to monitoring of quality parameters.

V. EVALUATION AND CONCLUSION

Monitoring of quality parameters, based on the scheduling method using time series prediction components, has been designed to achieve service-oriented architecture with lower overhead. This method provides more useful quality parameters for the service oriented architecture. In this method, the values predicted by the neural network and neuro - fuzzy will contribute in quality management. Quality management is being much enriched and more complex having known future values of a quality parameter. In this section the obtained data will be evaluated to prove the good performance of the prediction components .The data has been extracted from the WSdiamond website. In this resource, the values of quality parameters of web services including the run-time quality parameter, which we will use for the evaluation, are presented1.

A 3000- part series with neural networks

The3000-part series collection will be evaluated, using neural network component.

- **The first step,training80% of the data**

In this section,80% of data is used for training the network. The following figure shows the actual and predicted values. This figure includes80% of runtime quality parameters in the horizontal axis and their values in the vertical axis.

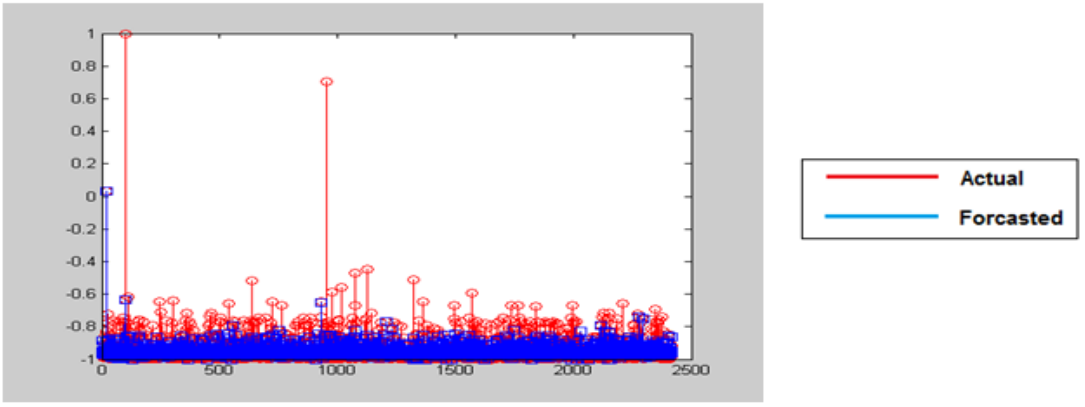

Fig 2: The actual and predicted time series

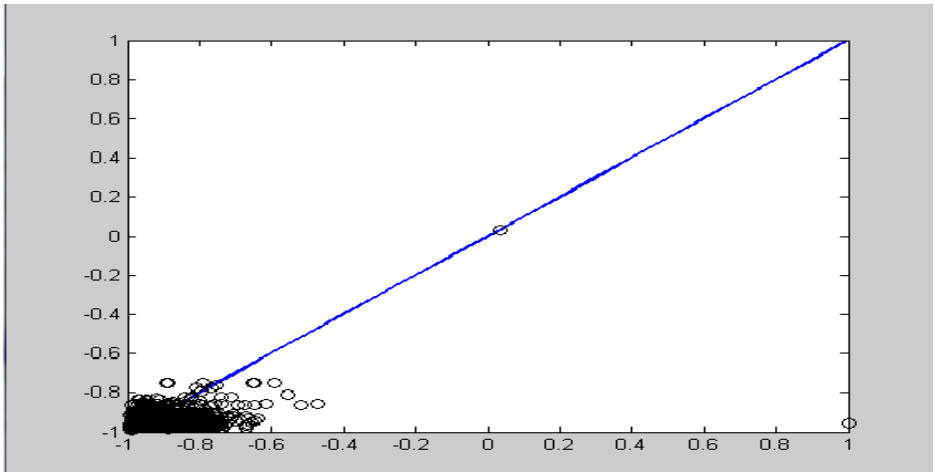

Fig 3: The accuracy of training set

[1]Experiment data are available at http://www.laas.fr/~khalil/TOOLS/QoS-4-SHWS/index.html

- **The second step, testing 20% of the data**

In this section, 20% of data is used for testing the network. The following figure shows the actual and predicted values in this section. This figure includes 20% of runtime quality parameters in the horizontal axis and their values in the vertical axis.

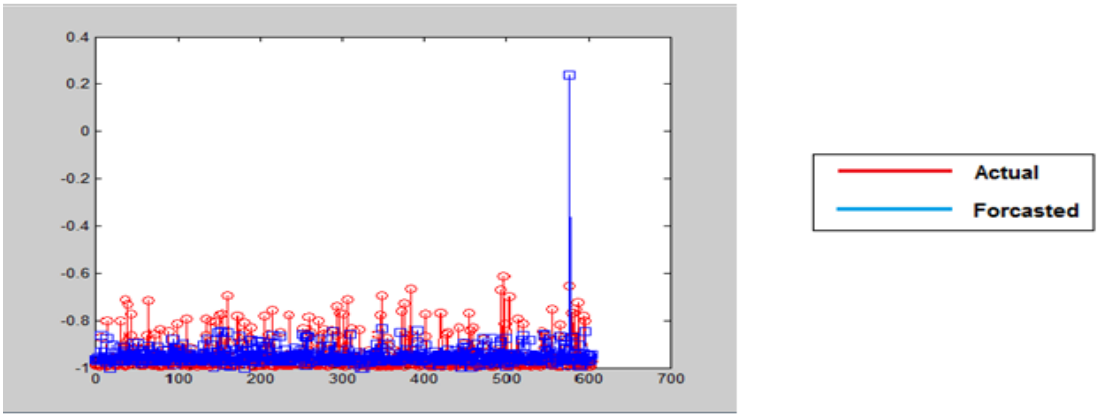

Fig 4: The actual and predicted time series

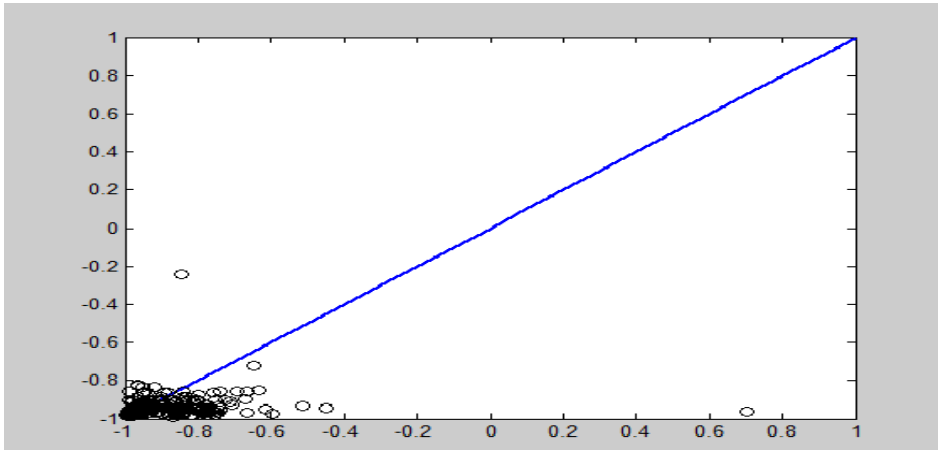

Fig 5: The accuracy of training set

In this section, A 3000-part series collection will be evaluated using fuzzy-neural network component.

- **The first step,training80% of the data**

In this section,80% of data is used for training the network. The following figure shows the actual and predicted values obtained in this section.

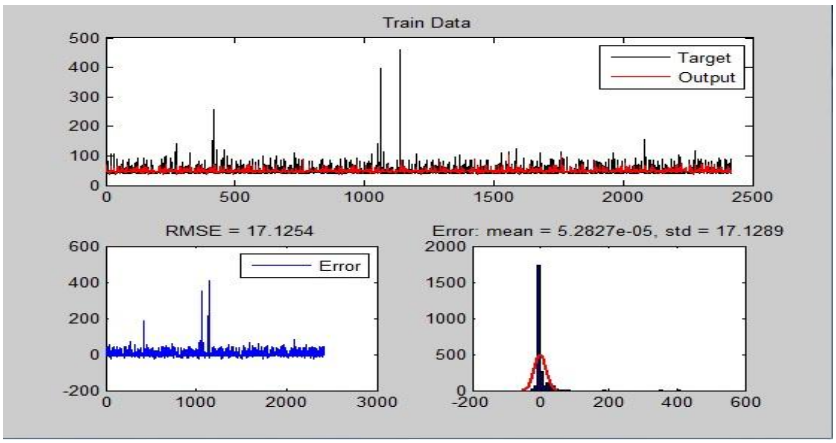

Fig 6: Charts representing predictions, accuracy, and mean square error

- **The second step, testing 20% of the data**

In this section, 20% of data is used for testing the network. The following figure represents the actual and predicted values obtained in this section.

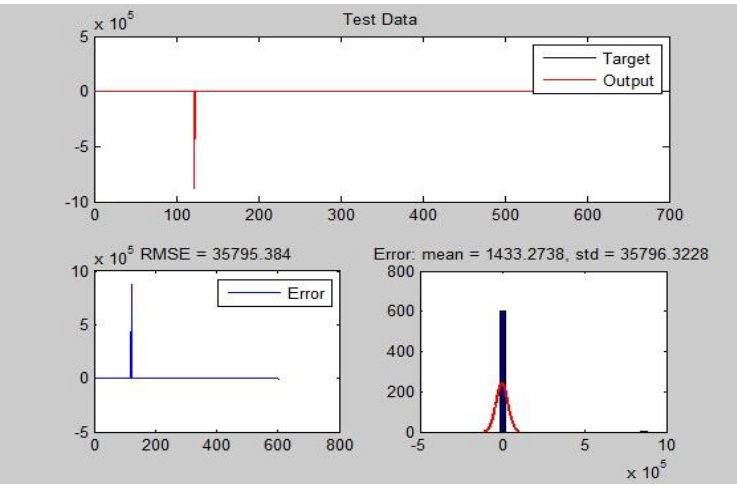

Fig 7: Charts representing predictions, accuracy, and mean square error

VI. CONCLUSION

The major aim of monitoring of quality parameters is to provide customers' satisfaction with the service is to continue their cooperation with the service provider. Monitoring of quality parameters based on data collection is carried out using various techniques. Monitoring is performed at each service call for customer to be aware of the level of quality of service received. The conventional methods of monitoring of quality parameters are causing overhead for architecture. The schedule approach is a way to reduce this overhead for achieving the optimal service-oriented architecture.

In this study, we proposed monitoring of quality parameters based on the schedule method using time series prediction approach. In this approach, the management scheduler component performs monitoring of quality parameters; it sends the obtained values to the prediction component, so the architecture does not need to perform re-monitoring in the next service calls. Reducing the number of monitoring, monitoring overhead is reduced and more efficient service-oriented architecture can be obtained.

Values predicted by the proposed method can be used for a better quality management of web services, therefore, a more helpful and more complex quality management can be created.

Using this method, the overhead of monitoring quality parameters is being less. Hence, the monitoring of quality parameters plays a more important role in service oriented architecture.

REFERENCES

[1] M.Endrei, A.Ang., A.Arsanjani,S.Chua,P.Comte,P.Krogdahl,M.Luo,T.Newling."Patterns: Servic Oriented Architecture and Web Services " ,IBM April. 2004.
[2] L.Srinivasan and J.Treadwell."An Overview of Service-oriented Architecture,Web Services and Grid Computing ",HP Software Global Business Unit .2007.
[3] C.Weiszmann." The role of Service Level Agreements in Successful SOA Deployments" .2006.
[4] R.Bashir,F.Azam ,A.Iqbal,A.Khanum and H.Malik,"A Comparative Model for Trade off Analysis of Qos Atributes in SOA", Journal of Basic and Applied Scientific Research, 2(11):11097-11105.2012.
[5] C.Ghezzi, and S.Guinea. "Run-Time Monitoring in Service-Oriented Architectures," in Test and Analysis of Web Services : 237–264. 2007.
[6] D.Bianculli and C.Ghezzi, "Monitoring Conversational Web Services," in IW-SOSWE'07,.2007.
[7] S.Benbernou ." State of the Art Report, Gap Analysis of Knowledge on Principles,Techniques and Methodologies for Monitoring and Adaptation of SBAs " .2008.
[8] WebInject. Available at http://www.webinject.org
[9] Sandact. Available at http:/www.syhunt.com/
[10] SoapKnox.Available at http://www.soapknox.com/index.html
[11] D.Touretzky and K.Laskowski," Neural Networks for Time Series Prediction".2007
[12] M.Hosein Zadeh and A.Seyyedi ," Qos Monitoring for Web Services by Time Series Forecasting".2012.
[13] A.Weingend and N.Gershenfeld,"Time Series PredictionForecasting the Future andUnderstanding the Past".2007.
[14] R.Halima,K.Guennoun,K.Drira and M.Jmaiel. "Non-intrusive QoS Monitoring and Analysis for Self-Healing Web Services" IEEE.2008.
[15] N.Repp, R.Berbner, O.Heckmann and R.Steinmetz," A cross-layer approach to performance monitoring of web services" In Proceedings of the Workshop on Emerging Web Services Technology. CEUR-WS, .2006