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RESEARCH ARTICLE

Management Decisions against Functional Violations of Web Services

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Abstract— The success of Service Oriented Systems mainly depends on the extent to which the user's functional requirements are satisfied. The execution of Web services needs to be monitored to know the performance during its operational period. Also it is important to take management decisions to control or modify its operations within the operational environment. In this paper, ten real world web services are monitored to gain knowledge about the deviation from the asserted guarantees by the provider of the Web service. Also appropriate management decisions to update the service to correct the deviations are proposed to reach the assertions mutually agreed by the signing parties of the Web service.

Key Terms: - Web service; Quality of Service; Service Oriented Systems; Cost of Service

I. INTRODUCTION

The increase in the volume of Web services also increased the potential risk to the enterprise system if one of the service components from another enterprise application fails to provide the expected output. So it is needed to monitor the performance of a service during its operational period to gain a clear knowledge. The monitored details can be useful for service providers, to take corrective actions for improving the services performance. This paper deal with the management challenges in improving the functionality of the Web service. Here the third party broker service is monitoring the performance of each non-functional parametric values and report to the top management of both the signing parties especially to the provider to update the specific parameter which need to improve its performance to reach the customer requirement [3]. Also the monitoring service checks the developments at the end of each billing term to confirm whether the provider put much effort to satisfy the customer requirements [10]. The experimental results indicate that the report about the deviation from the guarantees sent to the signing parties gives clear idea to the top management to take the appropriate action for immediate update.

II. MONITORING THE PERFORMANCE AND EVALUATION OF QOS OF WEB SERVICES

The guaranteed levels of performances are asserted by assigning appropriate weights to the non-functional parameters during its selection [5,6]. These weights are fixed by considering the domain dependent and independent attributes of a specific Web service. The performance of the Web service is monitored at runtime by monitoring the non-functional parametric values such as response time, availability, throughput, successibility, and reliability of the service during its operational period [7]. Here, the QoS of the web service is monitored and evaluated mainly based on the functional weight assigned to the non-functional parameter and the data collected from QWS Dataset [1]. The quality performance of individual parameter is also followed to reach the functional requirement of the web service for the continuous terms of evaluation. For this evaluation

ten real world Web services that are selected from the QWS data set [1] that belong to different application domains as in the table I. The measured values are recorded into the QoS database and the QoS is evaluated to check the service violations [9, 10]. The evaluated values are compared with the assertion to check the deviation from the level of guarantee violation agreed by the signing parties.

TABLE I
Real World Web services and its providers

Sl.No	Service Name	Provider Name	WSDL Address
1	GlobalWeather	webserviceX	http://www.webservicex.net/globalweather.asmx?WSDL
2	CurrencyRates	StrikeIron	http://ws.strikeiron.com/HouseofDev/currencyrates?WSDL
3	NewsReaderService	flash-db	http://www.flash-db.com/services/ws/newsReader.wsdl
4	PhoneVerify	CDYNE	http://ws.cdyne.com/phoneverify/phoneverify.asmx?wsdl
5	LoginService	Processclaims	http://www.processclaims.com/Service/LoginService.asmx?wsdl
6	RouteCalculationService	Viamichelin	http://www.viamichelin.com/ws/services/RouteCalculation?wsdl
7	NumberConversion	IDutchservice	http://www.ebob42.com/cgi-bin/NumberToWordsInDutch.exe/wsdl/Idutch
8	matcherService	Genome	http://genome.dkfz-heidelberg.de/menu/hobit/embapps/wsdl/matcher.wsdl
9	AddressFinder	arcWebservices	http://www.arcwebservices.com/services/v2006/AddressFinder.wsdl
10	AWSECommerceService	Amazon	http://webservices.amazon.com/AWSECommerceService/JP/AWSECommerceService.wsdl

The guaranteed nonfunctional parametric values mutually agreed by both signing parities at the time of selection of a Web services are mentioned in the table II.

TABLE III
Guaranteed non-functional PARAMETIRC values

Sl.No	ServiceName	Response Time	Availability	Throughput	Successibility	Reliability	QoS
1	Global weather	290	90	5	95	80	0.338
2	Currency Rates	210	95	4	99	60	0.384
3	NewsReaderService	135	65	8	65	75	0.646
4	PhoneVerify	140	80	3	80	70	0.502
5	LoginService	255	80	9	80	75	0.515
6	RouteCalculationService	145	99	25	99	70	0.707
7	NumberConversion	165	85	30	85	80	0.447
8	MatcherService	130	90	13	99	75	0.665
9	AddressFinder	160	95	2	95	80	0.706
10	AWSECommerceService	125	90	8	90	70	0.585

III. MANEGEMENT DECISIONS AGAINIST SERVICE DEVIATIONS

The deviation of all the five quality parameters response time, availability, throughput, successibility, and reliability of the Web service "GlobalWeather" is measured in each term to find the overall deviation from the agreed level and is shown table III. The overall billing term is divided into ten terms of equal number of invocations so that the provider and customer can understand immediate and accurate behaviour of the Web

service [2, 7]. The method of evaluating the deviation can be done by comparing the actual and asserted parametric values of the Web services.

Let S be the selected web service with the guaranteed level of quality parameters {P_1, P_2, P_3 ……..Pm} Where m ($1 \leq i \leq m$).

Where m is the number of non functional parameters considered for quality evaluation.

Let C_S is the cost fixed for the web service S with quality Q_S agreed by both customer and provider during its selection.

The deviation for each quality parameter is measured by finding the difference from the guaranteed and actual parametric values.

Dev (Pi) = Difference (Guaranteed Pi, Actual Pi), Where m ($1 \leq i \leq m$).

The overall deviation of a web service D_s is measured using the following equation

$$D_S = \frac{1}{m} - \sum_{j=1}^{m} w_j .Dev(P_j)$$

Where m ($1 \leq j \leq m$).

The deviation from the guaranteed level and the cost of usage of the web service are reported to the top management of the signatory parties to take immediate action for the update in the next term period.

Table iii

Deviation from the guaranteed level of quality Parameters - Global Weather

Request	Response Time	Availability	Throughput	Successibility	Reliability	QoS	Cost
Term I	-128.15	-5.2	-1.6	-10.9	5.2	-0.082	-0.29
Term II	-125.97	-5.1	-1.6	-12.7	-2.1	-0.105	-0.37
Term III	-128.26	-5.2	-1.6	-12.8	-3.4	-0.102	-0.36
Term IV	-128.28	-5.2	-1.5	-12.7	-6.1	-0.061	-0.22
Term V	-125.24	-5.1	-1.4	-12.4	5.1	-0.040	-0.14
Term VI	-127.70	-5.4	-1.8	-13.1	4.8	-0.094	-0.33
Term VII	-125.38	-5.1	-1.5	-13.0	5.2	-0.064	-0.23
Term VIII	-126.45	-5.1	-1.5	-12.7	5.4	-0.084	-0.30
Term IX	-122.99	-3.3	-0.9	-12.6	0.5	-0.141	-0.50
Term X	-122.19	-4.0	-1.1	-13.6	3.3	-0.104	-0.37
Average	-126.06	-4.9	-1.4	-12.7	1.8	-0.088	-0.31

The table III indicates that, in most of the terms the parametric values having negative deviation from the asserted values. It shows that the performance of the web service is not up to mark. Also the parameter "response time" shows very poor performance, this indicated that the service take more time to respond to the users request. Here the actual QoS of the Web service is 0.250 when compared with the asserted level of 0.338. It shows that the Web service's functionality is not reached. The overall deviation of QoS is - 0.088 which indicated that the customer's requirements were not satisfied by the provider of the service. Also the the cost of the service is 0.89 which is very low when compared to the asserted cost of 1.2 cents.

Table iv
The QoS, cost, overall deviation in comparison with asserted values – GlobalWeather

Terms	**QoS**	**Deviation in QoS**	**Cost**	**Deviation in cost**
Term – I	0.256	-0.082	0.91	-0.29
Term – II	0.233	-0.105	0.83	-0.37
Term - III	0.236	-0.102	0.84	-0.36
Term – IV	0.277	-0.061	0.98	-0.22
Term – V	0.298	-0.040	1.06	-0.14
Term – VI	0.244	-0.094	0.87	-0.33
Term - VII	0.274	-0.064	0.97	-0.23
Term - VIII	0.254	-0.084	0.90	-0.30
Term – IX	0.197	-0.141	0.70	-0.50
Term – X	0.234	-0.104	0.83	-0.37

The figure I shows the deviation of QoS and cost of the web service "GlobalWeather" from the asserted guarantees by the provider of the service.

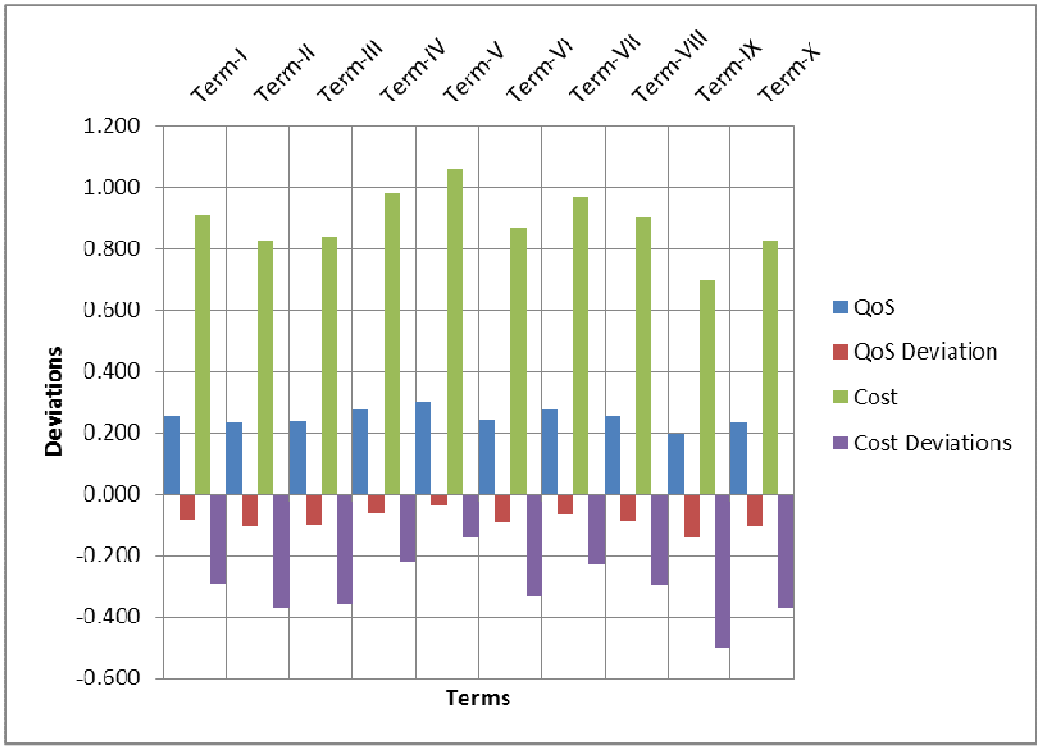


Fig. 1 The QoS, cost, overall deviation in comparison with asserted values – GlobalWeather

IV. RESULTS AND DISCUSSIONS

TABLE V
Term wise quality of the web service

Web Services	Term-I	Term-II	Term-III	Term-IV	Term-V	Term-VI	Term-VII	Term-VIII	Term-IX	Term-X
WS1	0.256	0.233	0.236	0.277	0.298	0.244	0.274	0.254	0.197	0.234
WS2	0.334	0.323	0.326	0.357	0.337	0.342	0.370	0.392	0.419	0.295
WS3	0.602	0.653	0.662	0.668	0.682	0.702	0.714	0.714	0.742	0.743
WS4	0.518	0.546	0.579	0.532	0.535	0.504	0.525	0.514	0.550	0.572
WS5	0.474	0.518	0.517	0.515	0.508	0.484	0.479	0.470	0.469	0.458
WS6	0.670	0.605	0.535	0.491	0.493	0.507	0.445	0.397	0.376	0.379
WS7	0.658	0.425	0.475	0.557	0.596	0.500	0.543	0.473	0.488	0.444
WS8	0.581	0.384	0.412	0.438	0.448	0.479	0.511	0.532	0.571	0.590
WS9	0.570	0.619	0.634	0.663	0.689	0.707	0.710	0.715	0.720	0.730
WS10	0.575	0.591	0.600	0.618	0.604	0.597	0.613	0.611	0.630	0.643

From the figure II and III, it is obvious that only four Web services (NewsReaderService, PhoneVerify, NumberConversion, AWSECommerceService) satisfied the customer requirements. In all these cases the provider's reputation is automatically improved and he is benefited in cost. Also the Graphs show that the quality of the Web services (LoginService,AddressFinder) slightly come down when comparing it with the customers expectation. But for the Web services (GlobalWeather, CurrencyRates, RouteCalculationService, MatcherService) the QoS of the service is very low from the asserted guaranteed. So these services lose its reputation and it may lead to the change of service.

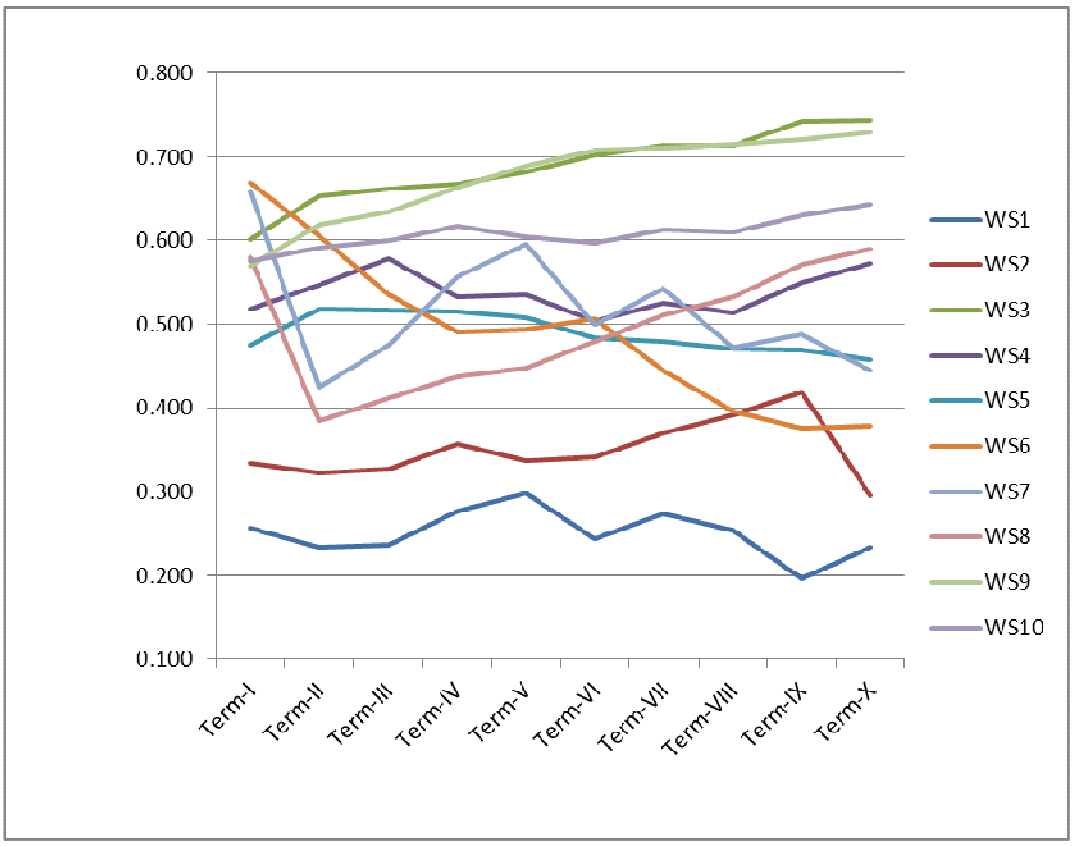
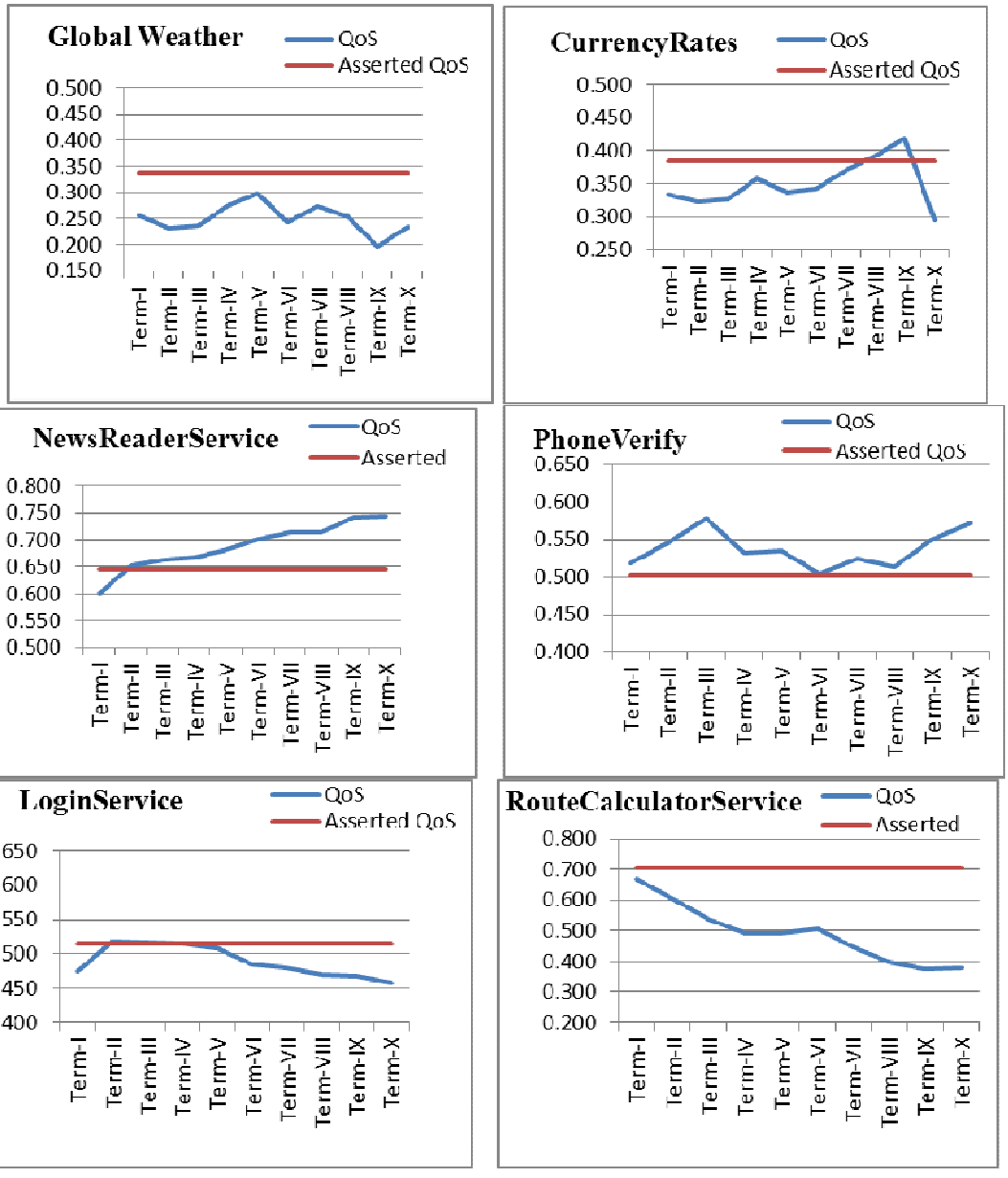


Fig. 2I. QoS of the Web service for continuous terms.

The figure III indicates the deviation of QoS from the expected QoS. If such violation is happen the provider and customer of the service can examine the term and the parameter that responsible for that deviation. So the corrective measures can be taken by the management of both the sighing parties to update the service.



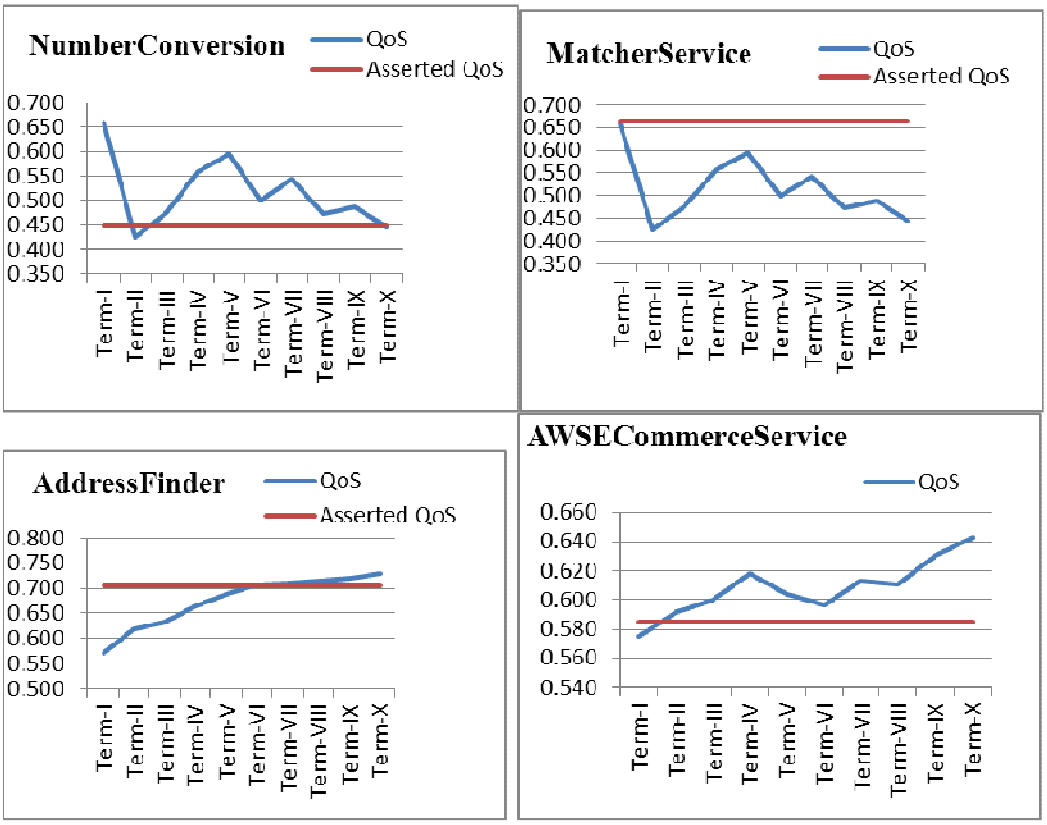


Fig. 3II. Comparison between asserted and actual cost for continues terms.

V. CONCLUSIONS

The nature of Web service leads to a software environment whereby applications are interdependent, and the performance of a one application rely on the general performance of other applications. To improve the operational efficiency of the Web services, several challenges such as dependency among application and reaching the actual functionality of the customer must be satisfied. It is necessary to provide a means to monitor and manage Web Service, for earlier detection of poor performance or failure in each given Web Service. This paper dealt with the actions taken in case of any violations or deviations happen from the guaranteed level of performance. Also this work is helpful to manage the Web services continuously though out its operational period to fulfill the functional requirement of the service customer, which is agreed by the provider at the time of selection.

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