WSLA Based Dynamic Monitoring and Pricing of Web Services

M.Mohemmed Sha, I.Sherif Baig, C.Rajalakshmi, P.Balaji, DR. K.Vivekanandhan

Abstract— In recent years, web services are considered as the only solution to solve the challenges in distributed web applications and its usage in Business to Business (B2B) integration increases steadily over a period of time. However selection of a web service that matches the user's requirement from the list of services with the same functionality needs more efforts to avoid dissatisfaction. Apart from the functional requirement the quality related aspects also considered for the best selection. Also the customer must need to know the quality of the offered web services as well as the price that they should pay for that quality. After selection, it is always not true that the web service meet the consumer's requirements. Always the clients think that they are paying for the service that is undelivered. In this paper, we are proposing an architecture that automates the costing and reporting the deviation of a web service based on its performance and user satisfaction. The costing is dynamically done by comparing the terms mentioned in the WSLA and the actual metrics measured by the third party, mutually agreed by the signing parties. On the basis of report from the third party we present an experimental validation, results and analysis of the proposed work**.**

Index Terms— Web Service, Quality Of Service, Service Level Agreement, Third Party Broker, Automatic Costing, Response Time, Throughput, Availability, Third party Broker, Dynamic Monitoring.

1 INTRODUCTION

THE success of Business-to-Business integration depends on finding new partners and their services in a global business environment. A WSLA defines assertions of a service provider to perform a service according to agreed guarantees for IT-level and business process-level service parameters and measures to be taken in case of deviation and failure to meet the asserted service guarantees. Also it presents how the service parameters are measured and aggregated to calculate the overall quality of the service provided. WSLA can be used by both service provider and service customer to configure their respective systems to provide and supervise their service. The instrumentation of service and service-using application can be instrumented to gain measurements for the evaluation of the WSLA. Also, parts of the WSLA (or derived information) can be passed on to third parties that support the WSLA's supervision [11]. The third party measures the metrics, compares with the guaranteed levels and the deviations are recorded.. The WSLA provides input to the measurement and management system of an organization that checks and manages an organization's compliance with a WSLA. For the economic benefit for both the parties the WSLA management system is automated for the process such as measuring, monitoring the QoS parameters, costing based on QoS and reporting the violations from the guaranteed levels [1].

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An implementation of the proposed WSLA based Monitoring and Costing architecture is discussed in section 2. Section 3 calculates the cost and the deviation from the guaranteed performance of the web service and Section 4 shows the experimental results.

2 FRAMEWORK FOR WSLA BASED DYNAMIC MONITORING AND PRICING OF WEB SERVICES (WDMPW)

In this framework the Third Party Broker get the metrics from the instrumentation function and check the guaranteed level of performance mentioned in the WSLA. Also WSLA provides input to the measurement and management system of an organization that checks and manages an organization's compliance with a WSLA [10]. The cost for the usage of service is calculated automatically based on the QoS by the third party service. The violation from the guaranteed level is reported to the management of both the signing parties for further action.

2.1 METRICS INSTRUMENTATION

In this framework the instrumentation of service and service-using application can be instrumented to gain measurements to check the actual performance of the service. The values measured dynamically when the service invoked by the client.

2.2 THIRD PARTY BROKER SERVICES

Here the third party Broker is sponsored by both the signing parties and can act the following roles:

2.2.1 MEASUREMENT SERVICE

A measurement service implements the measurement function required both signatory parties. The measurement functionality receives the measured metrics from the system's instrumen-

tation. Instructions on how to measure a particular system parameter are defined in the measurement directives of a WSLA.

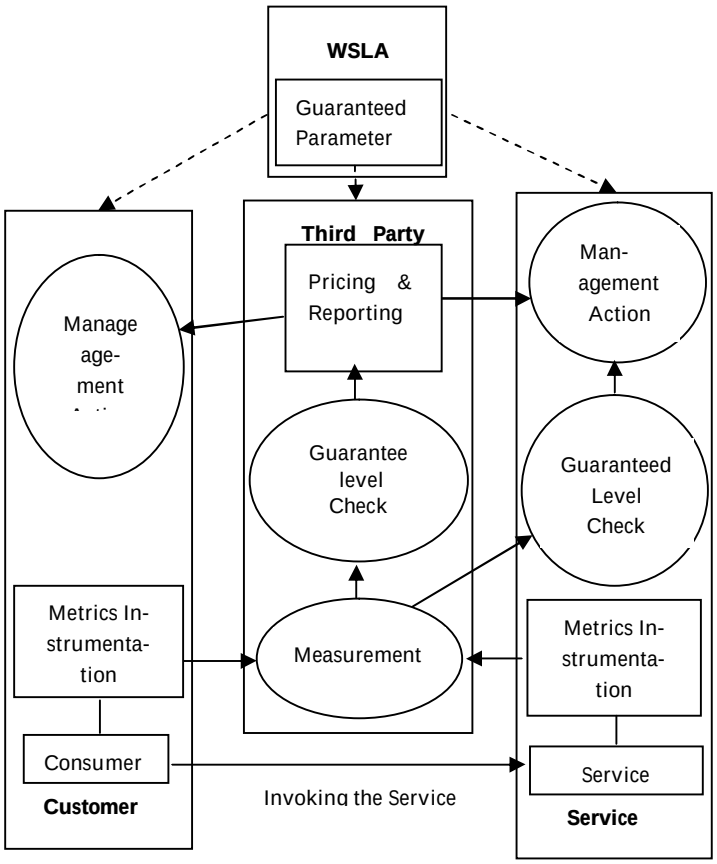

Fig 1. Architecture of Dynamic Pricing and Monitoring

2.2.2 GUARANTEE LEVEL CHECK

A Guarantee Level Check service implements condition evaluation function that covers all or a part of the guarantees of a WSLA in comparison with the parametric values from the measurement service.

2.2.3 REPORTING THE VIOLATION

If there is a violation from the guaranteed level of performance from the Guarantee level check service, the level of deviation is recorded in the QoS database and the action is invoked on the management function.

2.2.4 AUTOMATIC COSTING

Based on the actual parametric values from the measurement function, it is compared with the guaranteed level to check the QoS performance of the web service and actual cost for usage of the service is calculated.

2.3. MANAGEMENT ACTIONS

A management service implements the management actions of a signatory party. Management implements actions that are invoked upon guarantee violations [7].

3 MONITORING THE DEVIATION AND EVALUATING THE COST

Let S be the selected web service with the guaranteed level of quality parameters {P1, P2, P3 ……..Pm} Where m ($1 \le i \le m$) in the WSLA.
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.

Our goal is to check the violations and calculate the cost of the web service dynamically based on its performance in comparison with the guaranteed levels mentioned in the WSLA [4].

The basic metrics are measured by the customer and provider applications when the request is made (or the web service is invoked). A measurement service used by the third party broker get the metrics from both the signatory parties and aggregated into composite metrics and SLA parameters which are used to calculate the actual quality of the web service [3].

Let the broker reports the management about the violation and costing for the service for every N requests. These requests are equally divided into n sub requests and its average values is recorded and stored in the QoS database.

The set Ps AVG = {P1 AVG, P2 AVG …Pm AVG} is the average value for each quality parameter of the web service.

The parametric values are normalized as $P_{S\ NOR}$ = {$P_{1\ NOR}$, $P_{2\ NOR}$,……$P_{m\ NOR}$} and will be presented in the range of [0, 1].

The current QoS value of the web service can be calculated as follows

$$\text{Actual } Q_S = \frac{1}{m} \sum_{j=1}^{m} wj \,.\, Pj_{\,NOR}$$

Where w1, w2, w3,……wm are the weights assigned for the quality parameters.
The cost depends on the actual quality can be calculated as follows

$$\text{Actual } C_S = \frac{\text{Guaranteed } C_S \text{ x } Q_S}{\text{Guaranteed QS}}$$

The deviation for each quality parameter is also measured by finding the difference from the guaranteed parametric values.
Dev (Pi) = Difference (Guaranteed Pi , Actual Pi)

The average and percentage of deviation is also measured and stored in the QoS database to measure the overall deviation for N requests

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

The deviation and 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.

4 Experimental Results

Let us consider broker based monitoring and costing system reports the violation and prepare cost for every 10000 requests for a particular service *xlogic*.
The parametric values Response Time, Throughput, Availability, Scuccessiblity, Reliability are recorded for every 1000 requests and stored in the QoS database as follows

TABLE 1
RECORDED PARAMETRIC VALUES FOR THE REPORT TERM- TERM I.

Quality Parameter /Requests	P1	P2	P3	P4	P5
R1(1-1000)	762	5	81	91	81
R2(1001-2000)	765	4	83	87	86
R3(2001-3000)	761	4	86	81	79
R4(3001-4000)	749	8	90	85	83
R5(4001-5000)	745	9	82	81	89
R6(5001-6000)	743	6	86	95	89
R7(6001-7000)	768	5	91	96	90
R8(7001-8000)	766	3	90	94	84
R9(8001-9000)	765	5	89	79	82
R10(9001-	762	8	88	89	85
Average	758.6	5.7	86.6	87.8	84.8

4.1 Guarantee Level Checking and Violation Reporting

The deviation of all quality parameters P_1,P_2,P_3,P_4,P_5 are measured to find the overall deviation from the ageeed level for each terms and is as follows.

TABLE 2
DEVIATION FROM THE GUARANTEED LEVEL OF QUALITY PARAMETERS

QoS Parameter/ Terms	TERM-I	TERM-II	TERM-III	TERM-IV	TERM-V
Response Time	-2.59	-2.27	-1.68	-1.04	-0.61
Throughput	-8.69	-5.56	-3.8	-4.07	1.76
Availablity	-4.2	-2.73	-0.68	0	2.27
Successiblity	-6.67	-4.56	-3.32	-0.67	1.11
Reliablity	-6	-5.29	-3.18	-0.94	2

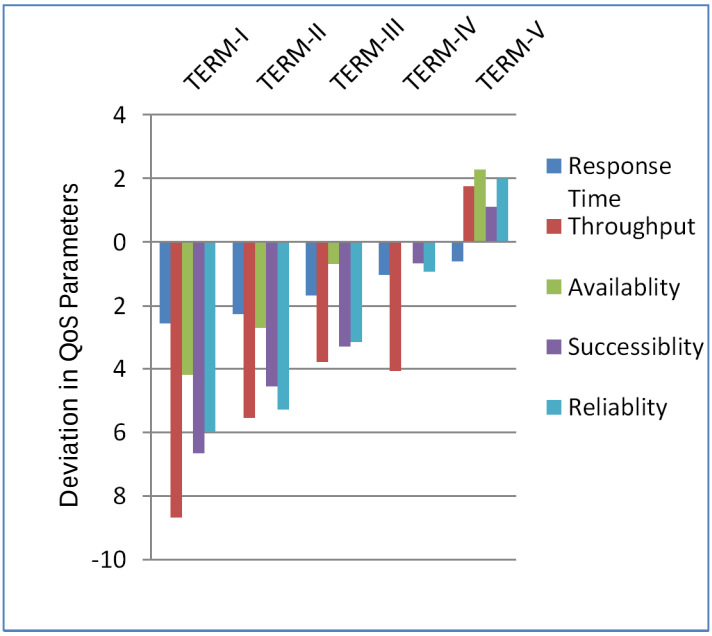

Fig 2. Violationof Quality parameters.

4.2 Costing Based on QoS

Let us consider w1= 0.9, w2=0.95, w3=0.85, w4=0.8, w5=0.9 are the weights to measure the quality of the web service and it can be calculated for Term-I as

Actual $Q_S = w1 \times P_{1\ NOR} + w2 \times P_{4\ NOR} + w3 \times P_{3\ NOR} + w4 \times P_{4\ NOR} + w5 \times P_{5\ NOR}$
$=(0.43+0.34+0.39+0.40+0.39)/5$
$=0.411$

Actual Cost = 0.426 x 1.2/0.411 = 1.12

In the same manner the cost for the continues terms are calculated.

The deviation for the Term-I as follows

$D_S = w1 \times Dev(P_1) + w2 \times Dev(P_2) + w3 \times Dev(P_3) + w4 \times Dev(P_4) + w5 \times Dev(P_5)$
$=((-2.59) + (-8.69) + (-3.99) + (-5.33) + (-5.4))/5$
$=-5.20$

The deviation for next terms also measured to check the violation from the agreed level.

TABLE 3
THE OVERALL DEVIATION, COST IN COMPARISON WITH THE QOS

Web service measures/Terms	TERM-I	TERM-II	TERM-III	TERM-IV	TERM-V
QoS	0.411	0.436	0.44	0.461	0.466
Overall Deviation	-5.2	-3.77	-2.31	-1.38	1.2
Cost	1.12	1.15	1.17	1.19	1.27

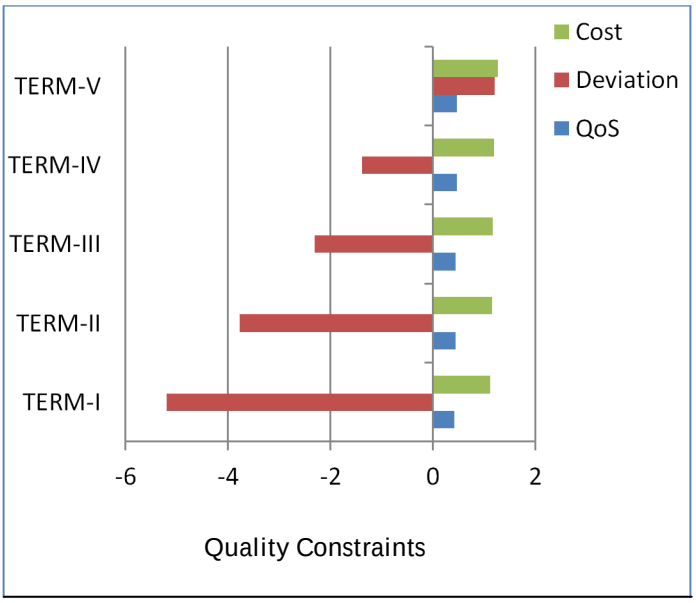

Fig 3. Deviation of quality parameters and corresponding Cost.

5 CONCLUSION

This paper helps for the dynamic costing and reporting of a web service as per the terms mentioned in the WSLA. Here the costing is done purely based on the actual performance of the web service and the reporting of violations to both the signing parties gives more impact because both are mutually benefited in cost and quality. Here the deviation from the guaranteed performace has been studied and reported to the management for immediate action. The result shows that the range of violation is reduced to a remarkable extend because the customer and the provider are aware of the business performance and quality delivered by the service. In future apart from the non functional parameters and the other factors like security, effective use of new IT infrastructure & Technologies and interest in integration of more business applications are considered as the performance measure for the web services.

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