Novel Sensing Approach for Predicting SLA Violations

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ABSTRACT: *Customer contentment plays a vital role in business environment. Service level agreements (SLA's) are signed between the service provider and the customer where SLA violation acts as a major constraint. SLA Violation is reduced through mechanisms involving Monitoring in case if any violations are probably to occur, predicting the violations in advance and applying necessary prevention mechanism that minimizes the total cost arising because of SLA violations. Service providers carry out adaptation measures in the case of violations. Adaptation is considered as an instant deed (i.e.) for each Composition instance separately. Most of the existing technique involves adaptation mechanisms based on cost alone but allow customers to compromise on quality. Our proposed technique provides optimal adaptation measures based on both cost and quality. Cost optimization and quality enhancing technique are been used in the proposed work to carry out the task. In this methodology we predict the SLA violations in advance and also find out the paramount providers through customers feedback and apply ranking for the services using the highest score. To achieve the highest score the service provider should provide services with minimum cost and maximum efficiency and quality. Also the existing work does not include mechanisms to completely prevent SLA violations, which is been enhanced in the proposed work by accumulating NOP (No to One-time Profit) technique.*

***Keywords –** Adaptation, Monitoring, optimization, prediction, Service composition, service-level agreements.*

[1]   INTRODUCTION

Web Service applications is still growing and most of the research are carried on service based applications. A web service in available applications fulfils multiple needs of the customers through appropriate service discovery [1]. The service composition has become a global business fashion. Composition is carried out based on the user's request which some time cannot be granted by any available provider. This issue has carried out interest to develop best mechanisms for service composition that validates the ever growing service trade, and to make everything as a service that can be obtained globally. To reach this goal the research also need to take dimension towards non-functional attributes like Quality of service (QoS) [2]. In the business world quality issues of services are not usually well defined during the signing process of service contract between the clients and the provider of the service. Some other services used in the composition may provide quicker response times but these services are often more expensive than time-consuming ones. Therefore, there is clear that tradeoff between preventing SLA violations and the inbuilt costs of doing so. If adaptation is only on cost, quality will get reduced for the service during adaptations. The provider if concentrates only on one time profit it will reduce the overall profit of the business organization since the customers do not stay back with them in future.

[2] RELATED WORK

The web service composition is a broad research area, and so many researchers have done research work in the new area of non functional attribute like quality of service [3], [4], [5]. Every level of hierarchy is designed as an independent composite service, managing execution of lower level services. It is also a common way of modelling high level solutions in workflow systems by composing a series of activities, each of which may communicate to a lower level business process, or a job to be performed by a person or a program [6], [7]. While the composite service is monitored or interrupted by the outside organization, it does not support any existing functional interaction for the service consumer except for an original invocation [8]. Adaptations are triggered by predicting violations, and are implemented as a substitution of fragments in the service composition. Fragments are full-fledged individual compositions, and are linked into the creative composition through special activities, which refer to virtual performance [9], [10]. Before replacement we estimate fragments with respect to their expected impact on the performance of the composition, and select those fragments which are best suitable to prevent a predicted violation [11], [12]. The Existing works establishes a framework that predicts the SLA violations that occurs between the service provider and suppliers. The SLA violations are predicted at run time and also

minimize the total cost of service provider. Adaptation is done to prevent violation on instance level for each composition instance separately. Aggregate SLO's that to be defining a number of cases are not a permanent adaptation. Adaptation is carried out to acquire a decision based upon the minimum cost arising from SLA violation. It is modelled as a one-dimensional discrete optimization problem. In addition to that they have presented deterministic and heuristic algorithms such as branch and bound, GRASP (greedy randomized adaptive search procedure), genetic algorithm. The optimization problems are generally solved by branch and bound. The part of solution are already contains at least one conflict, then it already prevents all SLA violations without pertain further actions. All iteration of this mechanism searches a specified area for better solutions than the current one. It is a Meta heuristic algorithm commonly applied to combinatorial optimization problem. The genetic algorithms (GAs) are more complex, but important and also powerful heuristic algorithm to generate good solutions to the cost-based optimization problem. To generate a random solution, select a set of solutions from the collection to survive into the next generation. A well known search technique called genetic algorithm used in calculates to find true or estimated solutions for optimization and search problems. Genetic algorithm is kind of a global search heuristics algorithm.

[3] SYSTEM ARCHITECTURE

The SLA violations occur between the service provider and the suppliers. The SLA violations are predicted at runtime. In Fig. 1 we describes the crisis of discovering the optimal set of adaptations, that minimize the whole costs occur from SLA violations and also the adaptations to prevent them. Adaptation is done to prevent violation on instance level for each composition instance separately. Aggregate SLO's which are defined as a number of cases are not a permanent adaptation measure. A service contract has service-level agreement (SLA) where a service is formally defined. The SLA is sometimes used to specify the service contracted delivery time or service performance. A service-level agreement is a discussed agreement between two or more parties, one is the customer and others are service providers. It can of either formal or an informal agreement such as internal department relationships. Agreement between the service providers should be established in the SLA and other third parties are often called SLA's hence the service level has been established by the requester. There is no agreement between third parties. These agreements are simply called contracts. These agreements should be provided to the customer with ranking or by scheduling the services. Because

of the scheduling methodologies the response time to the client becomes very small. SLO Predictor approach is used to identify the significant metrics which influence the SLO compliance of the composition. These metrics are the factors of influence for the service composition. Factors of manipulations are rarely clear, even to domain experts. Proposed process called dependency analysis, which is used by the business analyst to identify the factors of influence. This process is used to the extent that it is essential for considering the main role of the current paper. A semi automated process is called dependency analysis. To rely on the field of a human business analyst, but support it with computerization and discovery implements to ease tedious tasks.
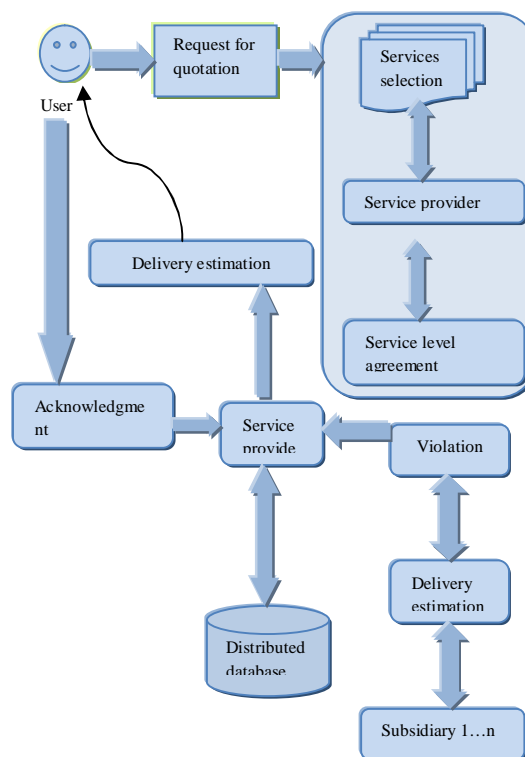

Fig 1. Architecture diagram

The high-level process is sketched. As a first step, the business analyst requests to define a list of potential factors of influence. It includes both domain specific metrics, which need not to be defined automatically and typical QoS metrics is automatically created that is for every used service, we create response time and availability metrics. For every important factor of influence that defined or created by monitored. It indicates how the metric is measured from running cases. Secondly, a data set containing these factors need to be created, either by replicating the composition of web service test location or by monitoring real executions with monitoring all potential factors of influences allowed. By using this data set, a

dependency tree can be created and it is essentially a decision tree, having the factors that best explains SLO violations in web service composition. The third step is to form a prediction model from the identified factors of influence. If this prediction representation has adequately high training data relationship against the calculated data set, if the prediction values are highly related with the actual calculated values, we can recognize these factors and use in the SLO predictor for the SLO prediction system. If the relationship is not satisfactory, the business analyst wants to identify the cause for the deficient performance. Normally, the analyst will define additional important factors of influence, and replicate from the second step.

[4] SLO ESTABLISHMENT

With its key customers, the provider has some established SLAs. We give a list of typical SLOs in Table 1.

TABLE 1

Service-Level Objectives

#	SLO Name	Description
1	Observed cost	Cost overrun with regard to the offer
2	Availability of service	The requested service will available or not
3	Response time	Time between request and response
4	Request fulfillment time	Time between receiving the request and finishing the process
5	lead time	The time between starting and ending the process
6	Specified specification	Service is exactly as specified or not

These objectives are of quantitative attributes of SLOs #1 to #5 or of qualitative attribute (SLO #6) in nature. All SLOs have some target values therefore, the Provider has a strong interest in observing to these SLOs and the service costs of doing it do not exceed the profit. The provider may concern a number of runtime adaptations for the process. We draw some example adaptation actions in Table 3. SLO's are the objectives of SLA's. We

consider SLO's like service cost, availability of services, quality of services and the reliability of the services. The columns # and _ refer to SLOs in note that these actions and impacts are of unique that is, for some business cases of outsourcing reduces costs and increase the process time duration this does not essentially hold for all processes.

[5] PREDICTING SLA VIOLATION

The service provider establishes service level contracts with the customer. There are many chances for violations to occur in service level agreement.
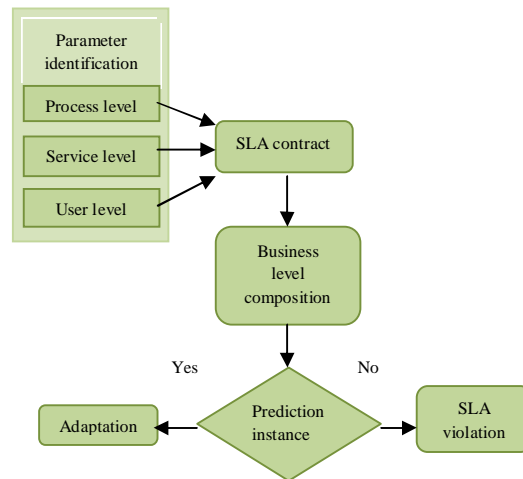

Fig 2. Predicting SLA violation

The word SLA is sometimes refers the contracted delivery time details of the service or performance. In Fig. 2 the SLA records consider the services, priority, tasks, guarantees, and warranties in general. SLAs commonly includes segment to address the meaning of services, performance measurement, problem managing, customer duty, warranty, failure recovery, and termination of agreement. There is nearly ten service level agreements f or each and every service given by the service provider. Among that three to four service level agreements may have a chance to get violated. This service level agreement violation should be predicted.

[6] ADAPTING MEASURES

The adaptation is used to solve the violation problem in the service level agreement. Adaptation is used to take immediate action and response by selecting appropriate decision to solve the violation problem. The service provider uses the adaptation for the cost optimization problem. Because of the adaptation the cost spent for the service level agreement violation is extremely decreased. And also it chooses the service with more or same quality and cost. Because of this it

will maintain the fame of the service providing company.

TABLE 2

Possible Adaptation Actions

#	Adaptation	Positive	Negative
1	Choose service with equal cost and quality.	#1	_
2	Choose service with less cost.	_	#1
3	Choose service with more cost.	#1	_
4	Choose service with more quality.	#1	_

In Table 2, #1 represents the action that takes place in the adaptation process. Adaptation considered to the present state of being adapted and to the active evolutionary process that leads to adaption.

[7] PAGE RANK CHECKING ALGORITHM

We use page rank checking algorithm in our work. This algorithm is easy to understand. The most important is the implementation rules for reducing the height of search tree. The Branch-and-Bound approach reduces the partial solution in two cases: 1) At least one conflict is already contained in partial solution or 2) All SLA violations are already prevented by partial solution without applying any more actions. In Fig. 3 the flow of the algorithm is illustrated which is found to be very effective.

```
Input:
      Update (DB, Service)
Output:
       Result (service, DB)
Steps:
   1.   Check (DB, input (value))
   2.   Update (DB, input value))
   3.   Modify (update, DB, Input value)
   4.   Result (Modify)
```

Page Rank was proposed as a possible model of user performance. The Page Rank of a page represents the chance that a random process will be on that page at the given time. A page score depends recursively upon the values of the process that point to it. Source process distributes their Page Rank across all of their out links.

Pseudo code of the Page Rank checking algorithm

Proc page rank (WG web graph, d damping factor ≈ 0.15) $\equiv$ N-|WG|

for each p $\in$ WG do

$\qquad$ Page $rank_p = \frac{1}{N}$

$\qquad$ $Aux_p = 0$

od

while (page rank not converging) do

$\quad$ for each p $\in$ WG do

$\quad$ r+ (p)←page rank pointed p

$\qquad$ for each p' $\in$ r+ (p) do

$$Aux, P' = Aux, P' + \frac{pagerank_p}{|r+(p)|}$$

$\qquad$ od

$\quad$ od

$\quad$ for each p $\in$ WG do

$$Page rank_p = \frac{d}{N} + (1\text{-}d)\ Aux_p$$

$\qquad$ $Aux_p = 0$

$\quad$ od

$\quad$ Normalize page rank: $\sum page\ rank_p = 1$
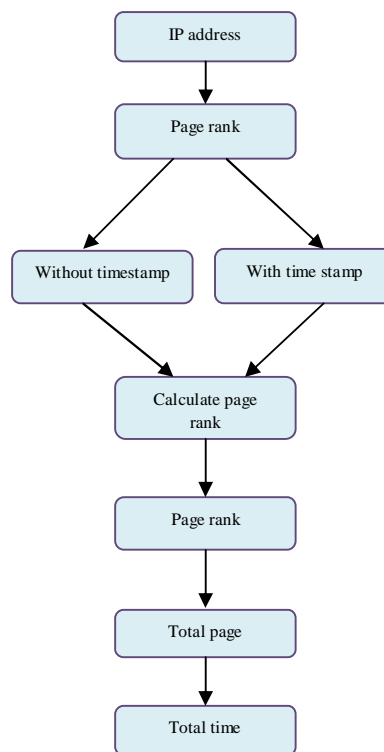
od

end

Fig 3. Data flow Diagram for Page Rank Checking

[8] EXPERIMENTATION & RESULT

The provider entity can be a person or an organization that provides an appropriate agent to implement a particular service. Similarly the requester entity is a person or an organization who wishes to make use of provider's entity. User can select the product and the provider grants the service based upon the service contract.

There are several providers providing services and the customer choose the services of the providers who provide the satisfying services. The requester entity makes the request for quotation and the products are selected from the product selection list. The service provider avails list of objectives in Service Level Agreement for the requester. If the customers are pleased with the objectives they continue and pay for respective services or the requester from the provider list can choose any other service provider as per their choice. If the agreement is found to violate then subsidiary selection is prolonged and carries out the task. The requester accepts the service and gives the acknowledgment to the provider.

In Table 3 the end to end results are illustrated for a sample composition of services.

TABLE 3

End-to-End Results

	SLO1	SLO2	total
Cost alone in Adaptation measure			
Violation predicted	201/120	440/2	641/122
Actual costs prediction	5201/2900	874/3	6075/2903
Disregard cost and Acquire quality			
Violation predicted	219/39	439/0	658/39
Actual costs prediction	5511/746	886/0	6397/746

The customer makes the Request for Quotation (RFQ) to the service provider that forms a contract that is the service level agreement between the service provider and the requester. The agreement makes the requester to trust the provider's service, responsibilities, guarantees and warrantees.

Fig. 4 represents the graphical view of our approach along with the existing one. From the below figure we can conclude that our method of compromising onetime profit is best since it ends in everlasting revenue of the organization.
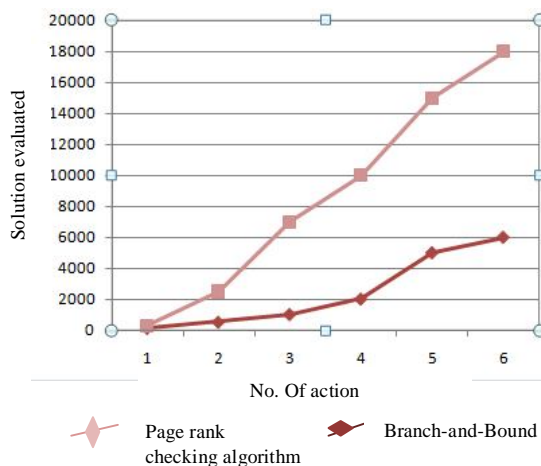

Fig 4. Solutions evaluated per vector modify algorithm

[9] CONCLUSION & FUTURE ENHANCEMENT

For web service composition, minimizing SLA violations are very significant for the service providers. We have proposed several enhanced mechanisms comparatively in this work.

Firstly the SLA violation is predicted and prevented completely using our method.

Secondly we have implemented ranking mechanism which acquires best service response.

Thirdly in our work, we have modelled this problem in a multidimensional manner.

Furthermore our system adapting NOP technique allows to concentrates on the overall growth of the sector in long term and increase the revenue steadily.

In future more effective algorithms can be used to increase the efficiency.

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