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Assessing Quality of Software Service at Selection Time Using Evolutionary Algorithm

T. MADHURI, R. RAJA SEKHAR M.Tech,(Ph.D.)

***Abstract*—The integration of external software in project development can be challenging and risky, because as the execution quality of the external software and the trustworthiness of the software is unknown during integration time. This is a timely problem. The proposed system has a solution for this. A evolutionary algorithm is devised for service recommendation, providing SaaS (Software as a Service) consumers with best possible choices based on quality. An automated rating model, based on service utility is also defined. The Pareto- ranking is introduced as a selection model. The results reveal that the proposed system is capable of providing the best possible choices for customers.**

***Index Terms*— Evolutionary algorithm, Service Rating Software as a service, Service utility**

I. INTRODUCTION

In recent years, IT industry has started to move toward a new model for software delivery, as the integration of project development with outsourced software is quite challenging and risky. The Software as a Service model lowers the risks because this is the model where, software is delivered on-demand and priced on-use. This is made possible by the adoption of fast internet access which is combined with widespread acceptance of SOA based solutions. The success of SaaS integration depends on the behaviour of the provider. Since software is provided as a Service, it is maintained by the provider. The risk factors related to the development using external software components has been reported in [11]. It has shown that risk reduction at software selection time is negatively correlated with occurrences of project development risks. In practice, the evaluation of quality of service cannot be performed until service is acquired.

The key characteristic of the proposed system is to automate the both selection and the rating of software services and increases the objectivity of the service quality reports. The ultimate aim underlying the development of this application is to reduce the risk associated with the utilization of external software services at selection time. The Evolutionary algorithm is a subset of evolutionary computation, often perform well approximating solutions. Based on the service utility, the feedback is generated[6]. Evolutionary algorithm follows the principle of survival of fitness to produce better approximations to a solution.

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***T Madhuri,** M.Tech Student, CSE Department, JNTUACEA, Anantapur, Andhra Pradesh, India,*

***R Raja Sekhar,** M.Tech ,(Ph.D.), Assistant Professor, CSE Department, JNTUACEA, Anantapur, Andhra Pradesh, India,*

The actual model with optimizations is implemented in Java Structs in the form of a prototype that allows the user to input various parameters based on the service chosen and obtain results with respect to the Usage of service and the rating is generated.

In this paper section-2 describes the different models and computations that were used for identifying the execution quality of the external software. Utility computation used for measuring the execution quality. Section-3 describes Evolutionary Approach, Section-4 describes the results that were obtained after using the services and section-5 concludes the work.

II. RELATED WORK

Review of literature is described in this section. The study made on the software service quality prediction resulted in finding several works carried out in the past. However they mostly deal with reputation aw systems which results in unfairness of service quality assessment. Service selection is a decision making problem. As discussed before, there is no guarantee of service quality at selection time. However, Evolutionary algorithm helps in predicting the likelihood of a quality to be met. Utility computation is performed to express the service execution quality.

A. *Utility Computation*

Utility expresses the conformance of service execution quality. The utility function can be considered as the distribution function that gives the probability of agreed quality level during the service execution. The utility function v is defined as a weighted product of utilities associated with each parameter Qi.

$$\upsilon = \prod_{Qi \in QoS(dim)} F_{Qi}^{eQi}, \qquad (1)$$

Where, for each Qos parameter Qi in QoS dim, F_{Qi} is a function that gives utility associated with each parameter. Based on the Utility of service the rating is generated for each service from the individual usage.

B. *Optimization Model*

The feedback for individual usage of each service is generated. Rating is divided into three ranges. Based on the range, the feedback is generated. Multi-objective fitness assignment (and with it multi-objective optimization) is concerned with the simultaneous minimization of *NObj* criteria f_r, with $r = 1, ..., NObj$. The values f_r are determined by the objective function, which in turn is

dependent on the variables of the individuals (the decision variables).

The superiority of one solution over the other can be decided by comparing 2 solutions. Following the schema in equation (2).

PARETO-ranking resp. PARETO-dominance:

=> Solution1 p< solution2 (p<: partially less than) (2)

If $solution_1$ is p< (partially less than) $solution_2$, it follows that $solution_1$ dominates $solution_2$. If costs and time are less for $solution_1$ than for $solution_2$, it follows that $solution_1$ which is superior to $solution_2$. It would be even sufficient if one of two values was equal for both solutions (equal costs) and only the other value was lower (less time).

If, however, none of the solutions dominates the other both solutions are to be regarded as equivalent with respect to the PARETO-order. The same rank is assigned to individuals which do not dominate each other.

The rank of an individual within the population ($rank_i$) depends on the number of individuals ($NumInd_{dominated}$) dominating this individual:

Rank = 1+NumInd(dominated) (3)

All solutions that are found during optimization and are not dominated by a different solution constitute the PARETO-optimal solutions (known as PARETO-optimal set) of this problem (PARETO-optimality). All these solutions are assigned a rank value of 1. In the case of each PARETO-optimal solution it is not possible to improve one of the criteria without one or several of th other criteria deteriorating.

III. EVOLUTIONARY APPROACH

Evolutionary algorithm, is a subset of evolutionary computation often to perform well approximating solutions by making use of optimization model. This algorithm follows the principle of survival of fitness, this to produce better approximations to a solution. There are several evolutionary algorithm techniques, among them Pareto raking was one of the best technique. Using these solutions obtained from optimization are compared based on the dominance and ranking was given. The aim of Evolutionary algorithm is to provide best fittest solution for a problem.

IV. EXPERIMENT AND RESULTS

The proposed prototype is implemented in Java Programming Language using Structs. The fig. 1 shows a screen used to capture architectural settings

Fig. 1 shows the rating table

As shown in the fig.1, after using the options, the user will sign out. Then basing on the utiltiy of options in particular service the rating is generated. Utility computation is made to obtain this. The rating table with the fields of customer name and rating for each service and individual rows for each customer details with respective rating will be generated.

Based on the rating generated for each service, the feedback is computed. From the solutions obtained from optimization, the ranking will be given for each service by making use of Pareto raking approach. Thus the execution quality of the services is identified by making use of evolutionary algorithm technique.

V. CONCLUSION AND FUTURE WORK

This paper proposes and implements an optimization model that is capable of providing best possible solutions for customers. An Evolutionary algorithm is used to know the execution quality of the external software service. The solution also considers the use of Pareto ranking to obtain set of solutions. The results of experiment with revealed that the proposed system is helpful in identifying the quality of External software services which reduces the risks during integration time. As future work we plan to extend the approach by generalization of selection mechanism to composite services with global equality constraints.

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T Madhuri, M.Tech Student, CSE Department, JNTUACEA, Anantapur, Andhra Pradesh, India,
R Raja Sekhar, M.Tech ,(Ph.D.), Assistant Professor, CSE Department, JNTUACEA, Anantapur, Andhra Pradesh, India