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Customized Cloud Service Selection based on Parameterized Weighted Average Model using user Rating

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Abstract **- Most of the individuals and organizations are migrating their work into the cloud environment due to the rapid growth of cloud computing performance. In this context, a lot of cloud service providers are emerging to offer cloud services which in turn resulted, the cloud customers with a number of choices to meet their requirements. From the cloud customers point of view, choosing an appropriate cloud service based on their customized requirement is a cumbersome job. In particular, we propose a parameter weighted average model based on cloud customer feedback ratings for each and every parameters. Cloud customers may give the highest priority to a few parameters from the accessible choice of other QoS parameters, which satisfies their requirements. The proposed model allows the cloud customers to prefer their personalized and customized choices on the basis of their prerequisites and also to help the cloud service providers to realize the requirement intention of the cloud customers and hence to improve the quality of services.**

Keywords— Cloud Service Selection, Weighted Average Model, User Feedback Ratings, Multi-Criteria Decision Making.

I. INTRODUCTION

The recent years, cloud computing influences the market due to pay-as-you-go model and delivers the resource in on-demand basis in nature. Generally, cloud computing is a service oriented computing. In this era, cloud computing usage has increased a lot. The vital role of cloud computing [1] is to increase processing speed, meanwhile it has to reduce the cost of cloud computing services in addition to increase in reliability, availability, etc. In cloud computing, resources are made available over the internet in on-demand basis. The various resources are hosted in the clouds like database services, virtual servers, clusters, etc. All these resources are rented to the clients by service based scenario.

Due to mode of operation and several benefits offered by cloud computing most of the individuals and organizations move their business and applications on it. In particular, a lot of cloud service providers will emerge day today with many differences and a variety of features in the cloud services that is being offered .Different providers may give varying efficiencies in different aspects of the services .For instance, one may provide the customer with a better storage space while the other may provide with an excellent security feature.

As a result the cloud users have a big pool of choices in choosing the cloud providers and adapting to the best one among them is really a burdensome and time consuming for the users. Currently, many researchers work on this issue and some approaches were suggested to choose the suitable service providers. Besides the user may also have customized requirements to satisfy their needs. For example, an application may need huge storage space with moderate security. To satisfy this kind of customized requirements, each parameter of the cloud provider has to be taken into account and analyzed. Hence we propose a weighted average model which takes into account all parameters feedback ratings from the cloud users. The proposed model considers the cloud user's preferences of each parameter and helps the cloud service providers to realize the requirement intention of the cloud customers and hence to improve the quality of services.

The rest of the paper is organized as follows. Section 2 reviews the related research work. Section 3 discuss about the proposed model for user preference based cloud service selection. Section 4 presents the result and analysis and finally Section 5 describes the conclusion and future work.

II. RELATED WORKS

In this section, we discussed various previous research work for evaluating, comparing the performance and approaches of different cloud services. Chang-Ling Hsu [3] , proposed a grey relational model for cloud service selection. Grey scale model is designed to identify the user's service level parameters by evaluating the nonfunctional characteristics of cloud services. They designed a data sources from any trusted third-party broker like cloudHarmony. It provides user rating and benchmark dataset. The system used fuzzy logic and grey scale technique to assign weight for features of cloud services. Yongwen Liu, et al. [4] proposed an assessment method of parameters using roughest theory. The system identifies the best cloud service based on performance. Performance is calculated based on the various parameters like number of CPU, memory size, storage space and operating system, etc. System used rough set theory to calculate the preferences of the requirements which is based on lower and upper approximation space. The attribute belongs to lower approximation that will be considered as irrelevant. System, analyzed the attributes as very important, important, good, and bad based on the score calculated by rough set theory.

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Ruby Annette et. al [5] proposed a framework to assist the cloud users to choose the best cloud service. It will identify the right cloud service based on QoS and reputation of requirements. Reputation is calculated based on consumer feedback. They have a designed reputation manager for gathering and processing user service ratings and it stores in a rating database. They have assumed rating value may differ from 1 to 10 where 10 depict highly satisfied and 1 depicts highly dissatisfied. Lie Qu et al. [6] proposed a context-aware cloud service, selection model which selects the cloud service based on a collective measure of cloud user feedback and performance testing. The system considers both subjective measures from users and objective measures from testing concerns. It measures the similarity between different contexts based on that objective assessment is modified on the fly. The system uses bipartite graphs to find the similarity of the assessment in different contexts. It reflects the overall performance of cloud service. Fatima Zohra Filali et al. [7] depicts the assessment of trust in cloud services and to provide best suited cloud service selection. Opinion model is used to design uncertainty of trust. Cloud service, selection depends on various things like direct trust, feedback of the consumer, QoS parameters. It is mainly based on performance, value and trust value so they are claiming that exact trust can be evaluated.

Manar ABOUREZQ et al. [8] proposed a cloud service research and selection system which is designed based agent systems. They have defined three agents for the following things:first one for user query processing, the second one for Skyline processing and the third one for cloud services research and selection. If the user query is fixed using existing ontologies to select the appropriate cloud service, otherwise (i.e. optimized query) pre-Skyline processing agent produces the result based on Cloud service research and selection system. Fan et al. [9] propose an evidential reasoning approach for multi-dimensional trust-aware selection of cloud service selection. Evidential reasoning integrates both perception-based trust value and reputation based trust value to find best trusted cloud service. Historical user feedback also affects the trustworthiness of cloud service. Deepak Kapgate [10] implemented a data center selection or prediction algorithm by using weighted moving average forecast model (WMAFM). They mainly focused on reducing the response time to clients. WMAFM suits for real-time time series data, since data centers have evolved over time, this model helps the user to select the best suited datacenter in cloud computing. This system considers features like Service request time, hourly loading, Virtual machine cost, etc.

Miranda Zhang et al. [11] developed a framework for automated cloud service selection. They have used two different techniques to build that framework. One is evolutionary optimization technique called genetic algorithm and the other is the decision making method. Evolutionary optimization is required to optimize conflicting requirements in terms of linear or non-linear functions. The system compares with the manual system for cloud service selection i.e. how much time user is taken to analyze the available cloud services and to take final decision of the cloud service selection. Zhipeng Gui et al. [12] proposed a cloud service recommendation system to assist the user to select cloud service. System has a collector module that collects the information like pricing, customer feedback, performance of a third party monitoring process, etc. different cloud system express the terms differently so unified model is required to create a generalized recommending system. Return on investment is used for price prediction which also depends on geo-location. But this system is expensive for parser maintenance due to change in URL and web content is often. Manikandan et al. [2] proposed an intelligent broker model to choose best cloud service, selection based on the user requirements. This system considers 24 different parameters which include both functional and non functional parameters based on the International Organization for Standardization (ISO) standards by the Cloud Service Measurement Index Consortium (CSMIC) to build an intelligent broker model.

III. PROPOSED WORK

This proposed work analyzes the intelligent broker model [2] with various cloud user requirements. The intelligent broker model may fail to get user preference based requirements which in turn will cause the failure of choosing customized cloud services. In this context, we proposed a weighted average model based on user parameter ratings to choose appropriate cloud services. This proposed model allows cloud users to prefer their personalized and customized choices on the basis of their priorities. Cloud users may give the highest priority to a few parameters from the accessible choice of other parameters, which depend on their needs. In this scenario, multiple cloud users may request cloud service with the same kind of requirements but for a different applications or different aspect of cloud service usage. For example, an application needs more storage, moderate security, less technical support etc., while the other may need more storage, average security , very less technical support etc., we need to provide the efficient cloud service, which depends on the user's necessity. For that, users are requested to provide preferences of each requirement. For each cloud service provider, weightage of parameters are calculated based on the previous user ratings. Consider we have 'm' number of parameters and 'q' number of cloud service providers. The weightage of the k^{th} parameter of j^{th} cloud service provider p_{kj} is calculated as follows:

$$\mathbf{p_{kj}} = \sum_{i=1}^{N} \frac{A_{ik} * i}{N * C}$$

Where N is the total number of users, C is the maximum value of user rating and A_{ik} is the total number of users who gave 'i' as the rating in the feedback for the k^{th} parameter. The same way we need to calculate the weightage for all 'm' parameters of all 'q' cloud service providers. After calculating the p_{kj}, the weighted sum of all cloud service providers have to be calculated and the maximum weighted sum depicts the most suited cloud service selection for the user. For each user requirement k, preference x_k is given by the user. The weighted sum of all cloud service provider e_j is calculated as follows:

$$e_{j=1\to q} = \sum_{k=1}^{m} \mathbf{p_{kj}} * \mathbf{x_k}$$

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The highest efficient cloud service is found as follows: Ej=max {e_j| where e_j is the weighted sum of jth cloud service provider}. The proposed model calculates the weighted average of user rating for cloud service usage is based on Algorithm 1.

Algorithm 1: Weighted average of user rating for cloud Service usage

Input: User requirement with parameter preference

Output: best cloud service provider

1. for all k∈P (Parameter set) and j∈S (Cloud Service Provider set)

   // U: User set. F (p_{kj}): User feedback of the k^{th} parameter of j^{th} cloud service provider

   for all i∈U∩F (p_{kj})

   // calculate the k^{th} parameter of j^{th} cloud service provider weightage p_{kj} based on user feedback

$$P_{kj} = \sum_{i=1}^{N} \frac{A_{ik} * i}{N * C}$$

   /*where, A_{ik} : the total number of user who give 'i' as the user rating in the feedback for the k^{th} parameter
   N: total number of users
   C: user rating maximum value */

2. for all k∈P (Parameter set) and j∈S (Cloud Service Provider set)

   //calculate weighted sum based on user parameter preference x_k and parameter weightage p_{kj}

$$e_{j=1\to q} = \sum_{k=1}^{m} p_{kj} * x_k$$

   Max=0

3. for all j∈S (cloud service provider set)

   if(e_j > Max)

   Max ← e_j

   E_j=max //E_j: best cloud service provider choice based on user parameter preferences

IV. RESULT AND ANALYSIS

In this research environment, Cloud Service Measurement Index Consortium (CSMIC) [13] has found metrics that are collective in the form of the Service Measurement Index (SMI), contributing comparative Cloud services evaluation. Customers can use these performance indices to compare various cloud services. For the experiments, the system has considered the SMI parameters like accountability, agility, Security & privacy, performance, assurance and economy. For this research, synthetic dataset is constructed based on 500 user ratings of six SMI parameters of respective cloud service provider. User rating for each of the SMI parameters varied from 1 to 5, where 1 as worst, 2 as bad, 3 as fair, 4 as good, 5 as excellent. Based on the proposed algorithm, Table.I, Table.II and Table.III are calculated to find best suited cloud service provider.

TABLE I. USER RATING WEIGHTED AVERAGE VALUE OF 5 CLOUD SERVICE PROVIDERS

Parameters	Cloud Service Providers				
	CSP1	*CSP2*	*CSP3*	*CSP4*	*CSP5*
Accountability	61.64	58.76	59.24	59.12	61
Agility	58.88	62.04	63.2	59.2	59.68
Security & Privacy	59.12	60.2	61.48	60.16	59.6
Performance	61.64	58.6	58.44	62.2	59.24
Assurance	61.12	57.6	60.72	60.2	57.96
Financial	61.4	60.56	61.68	59.28	61.4

In fig.1 shows the parameter wise weighted average value of user rating for five different cloud service providers. System considered this weighted average value as reference values to calculate the best suited cloud service provider based on user parameter preferences.

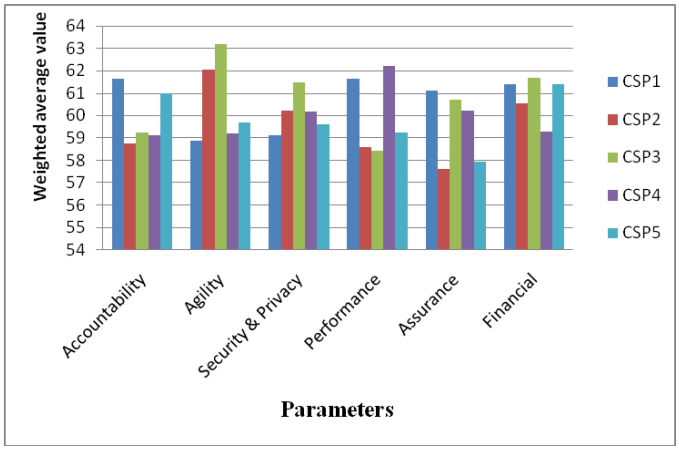

Fig.1 Parameter Weighted Average Value Vs Cloud Service Providers

Consider a scenario-1, Person X wants cloud services with the following requirement preferences: 70% Accountability, 85% Agility, 40% Security & Privacy, 80% Performance, 80% Assurance, 60% Financial.

TABLE II. AGGREGATE SUM OF THE WEIGHTED AVERAGE AS PER SCENARIO-1

Parameters	User Requirement	Cloud Service Providers				
		CSP1	*CSP2*	*CSP3*	*CSP4*	*CSP5*
Accountability	0.7	43.15	41.13	41.47	41.38	42.7
Agility	0.85	50.05	52.73	53.72	50.32	50.73
Security & Privacy	0.4	23.65	24.08	24.59	24.06	23.84
Performance	0.8	49.31	46.88	46.75	49.76	47.39
Assurance	0.8	48.9	46.08	48.58	48.16	46.37
Financial	0.6	36.84	36.34	37.01	35.57	36.84
Aggregate sum of the weighted average as per Scenario-1		41.98	41.21	42.02	41.54	41.31

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In Table.II shows the summation of weighted average calculation based on user requirement preferences for five different cloud service providers. Graphical representation is as shown in Fig.2.

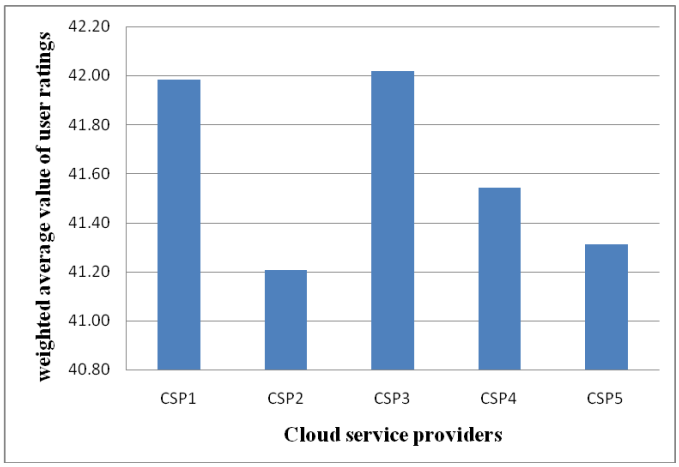

FIG.2 Weighted Average Aggregation Value Of Various Cloud Service Providers As Per Scenario-1

As per proposed system, for the given user requirement preferences (scenario 1) CSP3 (cloud service provider 3) is the best suited cloud service provider.

Consider a scenario-2, Person X wants cloud services with the following requirement preferences: 25% Accountability, 30% Agility, 60% Security & Privacy, 95% Performance, 80% Assurance, 60% Financial.

Table Iii. Aggregate Sum Of The Weighted Average As Per Scenario-2

Parameters	User Requirement	Cloud Service Providers				
		CSP1	*CSP2*	*CSP3*	*CSP4*	*CSP5*
Accountability	0.25	15.41	14.69	14.81	14.78	15.25
Agility	0.3	17.66	18.61	18.96	17.76	17.9
Security & Privacy	0.6	35.47	36.12	36.89	36.1	35.76
Performance	0.95	58.56	55.67	55.52	59.09	56.28
Assurance	0.8	48.90	46.08	48.58	48.16	46.37
Financial	0.6	36.84	36.34	37.01	35.57	36.84
Aggregate sum of the weighted average as per Scenario-2		35.47	34.58	35.29	35.24	34.73

In Table.III shows the summation of weighted average calculation based on user requirement preferences for five different cloud service providers. Graphical representation is as shown in Fig.3.

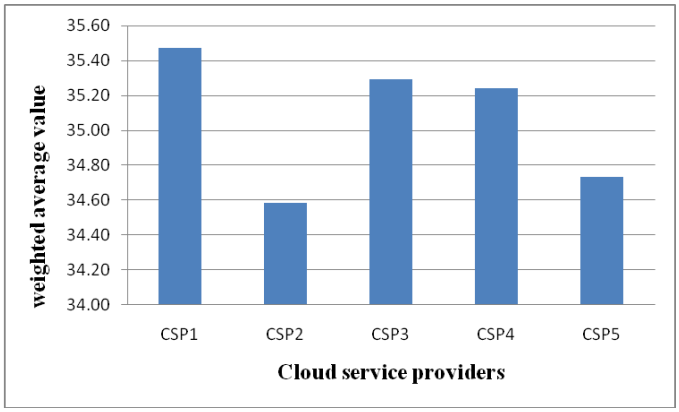

Fig.2 Weighted Average Aggregation Value Of Various Cloud Service Providers As Per Scenario-2

As per proposed system, for the given user requirement preferences (scenario 2) CSP1 (cloud service provider 1) is the best suited cloud service provider.

V. CONCLUSION AND FUTURE WORK

A traditional cloud with lifetime agreement at times leads to the following problems like vendor lock-in, no choice of usage and limited control. To overcome these problems the proposed framework with Intelligent Broker Model is designed which selects the best cloud service for the user requirement. In order to provide most suited cloud services for the user requirement, weighted average model is developed. The weighted average model is based on dynamic user rating of cloud service usage, it considers the user requirement with preference level and suggests the most suited cloud service selections. Cloud users may not be satisfied with recommendation of most suited single cloud service provider based on user rating. Our future work, leads to design a cloud service provider reputation model which suggests the user about the multiple cloud service provider with parameter reputation, ranking based on their necessity and sentiment analysis of user reviews.

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