Trust Integrated and Cost Based Grading Service Model in Federated Cloud Architecture

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Abstract: Cloud Computing is an   inevitable technology using by the internet users for their day to day usage, Various cloud service providers offering different services (like Software, Platform, Infrastructure, Storage etc,..) to various customers through the Internet. As service providers are countless, users are mystified to choose the best and cost minimized service provider. Our frame work designed based on user concerned, this will aid to user to select suitable and optimized cost service provider based on the necessary key performance indicators. We proposed frame work will address the key issues like User categorization, Trust analysis, Cost analysis, Grading the service providers and Priority based selection are used to select the appropriate service provider for their necessitate components.

Keywords: *Package Grade Table, Priority Decision Tree, Transparency Trust Analysis Model[TTAM], Reputation Trust [RT]*

1.   INTRODUCTION

Cloud computing is an interconnected computing resources to provide on demand access basis to the user, (*e.g*., infrastructure, platform, and software) Cloud computing identifies five characteristics: [2 *Cloud Characteristics* [2] are wide network access, Resource pooling, rapid scalability, and Billing service.

Resource Provisioning: User self-provisioning, dynamic provisioning, Advanced provisioning. Ranking model for SLA resource provisioning management (C.S.Rajarajeswari, M.Aramudhan, 2014), papers discussed about resource provisioning to user, based on their requirements.

1.1. Key Performance Indicators

Key performance Indicators used to appraise the cloud service providers [4]. Availability, Service/System availability, Cost, Performance, Capacity, Response time, Elapsed time, Meantime between failure, Meantime to repair, Throughput, Bandwidth, Processor speed, Storage capacity, Storage Types, Service/System scalability, Security, Audit, Back up etc,.

In our discussion: Section 1: Related work, Section 2: Proposed Work, Section 3: Cloud Federated Broker Architecture, Section 4: Cost analysis, Section 5: Priority Decision Tree, Section 6: Transparency Trust Analysis Model and Reputation Trust, Section 7: Simulation Results and Discussion.

2. RELATED WORK

C. S. Rajarajeswari, M. Aramudhan, [1] (2014) Ranking Model for SLA Resource Provisioning Management proposed poin care plot methods to order the service providers. M. Mohemmed Sha, T. Manesh, A. Mohamed Mustaq Ahmed [3] (2016) presented to assess the QoS and Cost of Web Services Based on Its useful performance. Saurabh Kumar Garg a, *, Steve Versteeg b, Rajkumar Buyyaa A[5] framework presented for order of cloud computing services.(2013),PreetiGulia, SumedhaSood[4](2013) proposed selection and ranking of clouds is done by matching user requirements with Service Level Agreements by assigned weights.

3. PROPOSED WORK

The proposed frame work will address the key issues like User categorization, Trust analysis, Cost analysis, grading the service providers, and Priority based selection are used to select the appropriate service provider for user requirements. Hence user categorization separating cloud user as registered and non register, Trust to be assessed by matching the Cloud Security Alliances (CSA) control group and reputation, Cost analysis based on the Service Level Agreement (SLA) aware cost of components, grading to be done package grade table, finally Priority Decision Tree applied to select best service provider from similar user submission cost range service providers. We used scaling grades are Gold, Silver, and Bronze.

4. CLOUD FEDERATED BROKER ARCHITECTURE

Enhanced Federated Cloud Architecture divided into three regions such as User region, Federated Agent region, and Service Providers region.
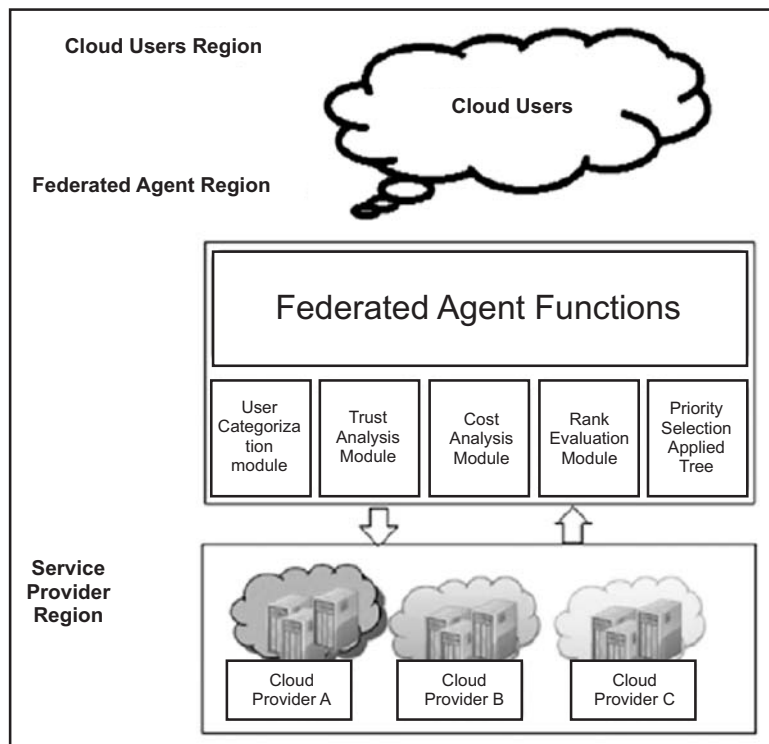

Figure 1

4.1. Cloud Users Region

Users zone describe that cloud users. Users access cloud services from anywhere at any time. Some of the users try to persist with only particular service providers; they registered and regularly access same service providers without concern about cost and others in the internet world, but most of the users like non registered with any particular service providers try to identify best service providers or low cost service providers from pool of list available in the open networks. Former users may not completely depend on the any frame work model, but later users need help of any frame work model to identify best service providers/low cost service providers.

4.2. Federated Agent Region

Federated Broker Manager assigned (FBM) as Federated Agent. Functions of proposed federated agent are *i*) User categorization *ii*) Trust Evaluation, *iii*) Cost analysis, *iv*) Ranking evaluation *v*) Priority selection based on user request.

5. COST ANALYSIS

The proposed cost analysis designed based on user submission cost, Service providers to be alienated based upon users Cost.. We have proposed dynamic package to categorize service providers various level of grades like Gold, Silver and Bronze based on cost and also it helps to choose service providers dynamically from the package table. Priority model also applied when user meet similar cost in the pool. Finally user will be benefited from this framework.
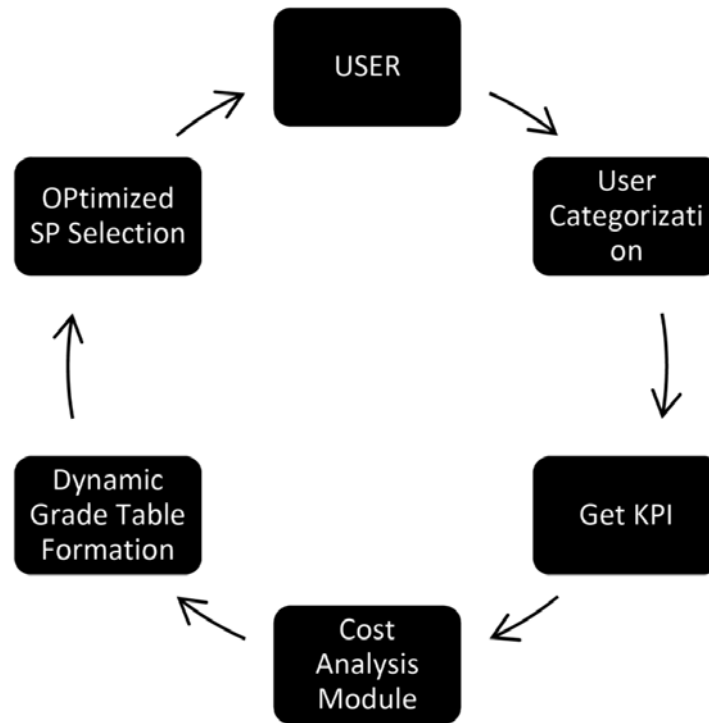

Figure 2

Algorithm Cost-Analysis

Step 1:

Get the user components $[\text{Components} = UC_1, UC_2, UC_3.....UC_n]$

Step 2:

[SLA Total Cost of Each Component] per Service Provider

$$[Y] = \left[\sum_{j=1}^{n} Cij \right] i = 1, 2, 3 ... N$$

Step 3:

List of Service Providers $\{ SP_1, SP_2, SP_3, SP_4.............SP_N \}$

List of Total Cost of Each Service Providers $\{ Y_1, Y_2, Y_3, Y_4, Y_5............Y_N \}$

Step 4: Package Table Display

IF (Total Cost$[SP]_n$ > User submission Cost) ; N = 1, 2, 3...... R

Set as 'Gold' ;

IF (Total Cost $[SP]_N$ == User submission Cost)

Set as ' Silver ' ;

IF ((Total Cost$[SP]_N$ < User submission Cost)

Set as 'Bronze';

End Procedure;

n – Number of components

[SP] – Service Provider

[C] – SLA Cost of Component

N – Number of Service Provider

[Y] - Sum of each component cost of service provider

N – Number of Service Provider
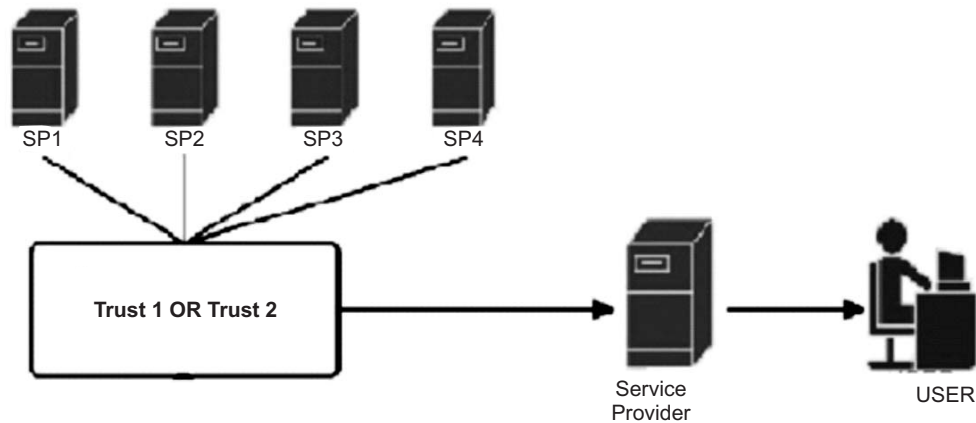
6. PRIORITY DECISION TREE

Figure 3

Priority Decision tree (PDT) represents rules to separate service provider from similar rank in user submission cost. Input to the decision tree is transparency trust and reputation trust. From the results of decision tree user allow to choose optimized and trusted service provider.

Trust[SP]) = {Transparency Trust(R_{out}(CG – ID, C– ID, A)) **OR** Reputation Trust(Positive response)}

7. TRUST ANALYSIS MODEL

7.1. Transparency Trust Analysis Model [TTAM]

Transparency Trust Analysis Model evaluated from Cloud Security Alliance (CSA) Star Registry. In the cloud transparency trust the idea is to provide self-assessments by the Cloud Service Provider (CSP) on their own[10].

The CSA STAR registry [10], designed to index the security features of cloud providers using Consensus Assessments Initiative Questionnaire (CAIQ) for the STAR attestation along with the requirements document given by the user. In the CSA STAR (CAIQ) categorized Control Group ID, Control ID and an Answer. The Federated Cloud Broker converts these information from registry into form of R_{out} **(CG – ID, C – ID,A).**

The FCB receives the requirements from the user in a plain text document format, and convert it to the form R_{in} **(CG – ID, C – ID, A).** The FCB then compares both the constraints and assign the weight age for every answers. Weights are 1 and 0 finally total weights to be calculated and identified the maximum weightage service provider for user as the trusted service provider otherwise the FCB moves on to the next CSP and performs the checking till the trustable CSP is found.

Control Group ID: Differentiate various sectors ID(Like Information security(IS), Data governance(DG)) Control ID – Identify the Particular constraints in the control group and A is condition variable verified at user and CSP by Federated Cloud Broker.
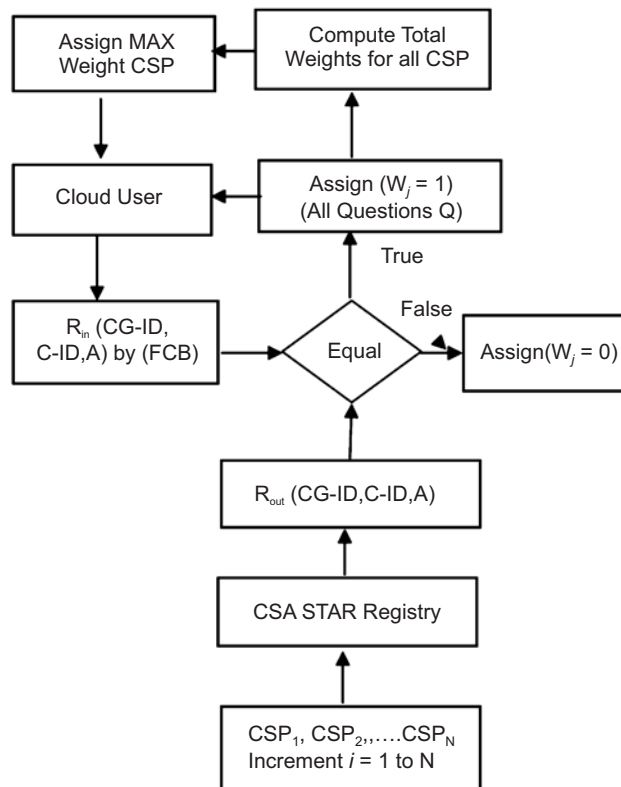

Figure 4

CSP: Cloud Service Provider

$$W_j - \text{ Weights } j = 1, 2, 3…..Q \text{ (Questions)}$$

7.2. Reputation Based Trust Analysis Model

Service providers also measure reputation based trust analysis, in this context users past experience would consider for choosing the best service, Hence user comments categorize as positive comments and negative comments.

$$\text{Total Customer response } = \text{ Positive Response + Negative Response}$$

$$\text{Positive Response in (\%) } = \left[\frac{\text{Positive Response}}{\text{Total Customer Response}} \right] * 100$$

Positive response threshold varies from 100% to 0%, from our discussion 90% and above results of positive response from various customers taken account to select trusted service provider.

8. SIMULATION RESULTS AND DISCUSSION

In research discussion accounted nine service providers, Federated Agent received the request and identified user require components from the consumer, then verified the availability of services and listed out the service provider. SLA cost of each component of service provider accumulated and stored in dynamic grade package table according to the algorithm, now user ready to prefer service provider based on the grades available in table. Grade Silver package shows requirement of the user submission cost, User also prefer to choose gold and bronze service provider based on the interest, hence gold shows higher cost than user submission and bronze shows very less cost than user expectation. User also permit to verify the trust of service provider through trust evaluation module, two types of trust evaluation presents in this frame work they are transparency based trust analysis and reputation based trust analysis both trust also used to solves the issue of similar total cost of service providers, when user submission cost satisfying multiple service provider, user prefer priority based decision tree, it will identify the trust either transparency trust or reputation trust. From the priority based decision tree results user suggest choosing optimized service provider.

Table 1

| User Requirements (types)	User Components/ Duration	SP 1 Cost ($)	SP 2 Cost ($)	SP 3 Cost ($)	SP 4 Cost ($)	SP 5 Cost ($)	SP 6 Cost ($)	SP 7 Cost ($)	SP 8 Cost ($)	SP 9 Cost ($)
Processor speed(vCPU)	2.4GHz/Day	0.0025	0.0015	0.0010	0.0030	0.0010	0.0018	0.0100	0.0030	0.0030
Memory (RAM)	2GB/Day	0.0015	0.0010	0.001	0.0020	0.0010	0.0016	0.0150	0.0020	0.0020
Capacity	100GB/Day	0.0025	0.0020	0.0015	0.0030	0.0010	0.0020	0.0020	0.0010	0.0030
Data Transfer Rate	100TB/Day	0.001	0.000	0.0010	0.0020	0.0010	0.0001	0.0010	0.0010	0.0000
Platform	Desired OS/Day	0.0015	0.0010	0.0010	0.0025	0.0015	0.0010	0.0010	0.0025	0.0011
$[Y] = \sum_{i=1}^{n} C_i$		0.009	0.0055	0.0055	0.0125	0.0055	0.0065	0.029	0.0095	0.0091
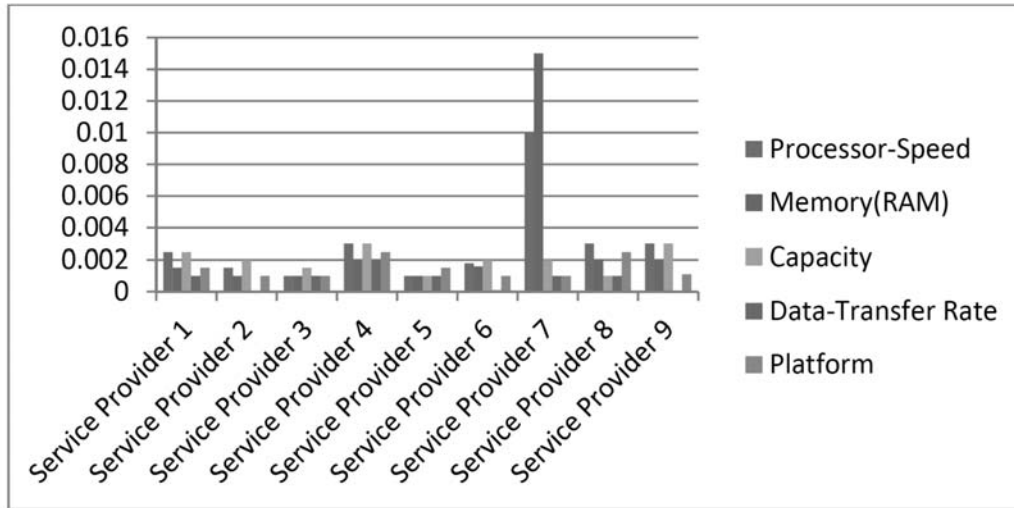
Figure 5

Above graph shows that vertically cost in $ and horizontally Service providers components, package table shows the grades Based on the user submission cost, hence user submission cost in $ 0.0060 to 0.0065.Package grade table displayed in table

Table 2

SP	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9
Cost Total	0.009	0.0055	0.0055	0.0125	0.0055	0.0065	0.029	0.0095	0.0091
Grade	Gold	Bronze	Bronze	Gold	Bronze	Silver	Gold	Gold	Gold

9. CONCLUSION AND FUTURE WORK

This research emphasized the grade assignment to different cloud service providers based on cost of key performance indicators. This frame work not only solves ambiguity among the cloud user also creating a healthy competition among the cloud service providers so that they able provide quality and cost reduced and trusted services to user. Hence trust evaluation need not to done at end of the grading service provider, at beginning also be able to compute it. We planning apply fuzzy set to assign grade and trust evaluation in future.

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