SECURED SERVICE PROVIDER SELECTION METHODS IN CLOUD

R.Devi
Assistant Professor
Department of IT
GCT, Coimbatore-13
devi7arr@gmail.com

R.Dhivya
PG Scholar
Department of CSE
GCT, Coimbatore-13
dhivya.rathinasamy@gmail.com

Dr.R.Shanmugalakshmi
Associative Professor
Department of CSE
GCT, Coimbatore-13
drshanmi@gct.ac.in

***Abstract*—Cloud computing is an important trend and experienced exponential growth over the last few years. Almost sixty percent of current small-to-medium businesses (SMB) use cloud services. The growth is only expected to increase over the next few years. However, the control of data over the cloud is less for the customers. Hence we lack in trust management which is near about two percentages of the total services provided. Prefer a cloud service provider among numerous vendors based on qualitative and quantitative manner is a challenge for the cloud customer. This paper on the theme of brief examine in existing models which are used for cloud service provider selection in cloud environment and we analysed the criteria which can be improved to provide the best selection.**

Keywords: Cloud computing, Cloud service provider, Selection factors, Trust

I. INTODUCTION

The National Institute of Standards and Technology (NIST) is a measurement standards laboratory which defines the cloud computing as,

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"[1]. NIST characterize the cloud as On-demand self-service, broad network access, resource pooling, rapid elasticity, measured services [2].

A *cloud provider* is a company that offers some component of cloud computing to other businesses or individuals. Cloud providers are sometimes referred to as cloud service providers or CSPs.

A *cloud customer* is a person or company or organization that gets service from, cloud providers.

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A cloud service is any resource that is provided over the Internet. The most common cloud services are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).
SaaS is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet. PaaS refers to the delivery of operating systems and associated services over the Internet without downloads or installation. IaaS involves outsourcing the equipment used to support operations, including storage, hardware, servers and networking components, all of which are made accessible over a network. SaaS, PaaS and IaaS are sometimes referred to collectively as the SPI model [3].

Even many services available in cloud environment, as a consequence of low burden on installation and maintenance of software, SaaS becomes more popular in recent days [4]. Therefore many service providers offer services with similar functionality. Customer has to choose the best service provider among the numerous vendors before upload the data in the service to avoid the risks of failure. Without the usage of service, selecting a best provider is very difficult. Thus a framework is needed to evaluate provider based on some specific factors and feedbacks. Those factors will differ for customers to customers.

The rest of this paper is organised as follows. Section 2 gives the concise explanation and comparison of the various frameworks which are existing to rank or prioritize the service providers. Section 3 concludes the view of different selection models.

II. EXISTING PROVIDER SELECTION MODELS:

Before describing the selection models, we need a basic knowledge about, what are all the factors involving in SaaS service provider selection. According to the usage or need of services, the

requirement of the customers will change. In [6], they provide some parameters require for evaluation in both customer and providers perspective. Four main factors considered. They are (1) technical (2) Strategic & Organizational (3) Economic (4) Political & Legislative. Different existing service provider selection methods consider different factors to prioritize the vendors.

In [7], authors proposed T-Broker: a Trust-Aware Service Brokering Scheme for Multiple Cloud Collaborative Services. A cloud broker is a third-party individual or business that acts as an intermediary between the service provider and cloud customer. T-Broker acts as middleware for trust management and service matching. As most of the brokers do not provide trust management capabilities for multiple cloud collaborative computing, so the authors constructs a brokering system for efficient matching providers to satisfy different user's requests. In this architecture five important components are available. (1) Sensor Based Service Monitoring (SSM) to monitor the service parameters. (2) Virtual Infrastructure Manager (VIM) obtains the information from vendors and acts as resource management interface for monitoring system. (3) SLA Manager and Trusted Resource Matching to prepare list of the best trustworthiness resources for service request then the highly trusted resources are selected from the resource pool. (4) Hybrid and Adaptive Trust Computation Model (HATCM) to sort high performance resources by analysing the history information of the resources. (5) Services Feedback and Aggregation (SFA) use lightweight feedback mechanism to reduce networking risk. The overall *trust degree of service* resources (OTD) is calculated as follows

$$O_{\nabla\lambda}(r_i) = (1-\gamma)R_{\nabla\lambda}(r_i) + \gamma F_{\nabla\lambda}(r_i) \quad (1)$$

Where γ is weight factor, $\nabla\lambda$ is time window, $R_{\nabla\lambda}(r_i)$ is Adaptive real-time trust computation result of resource i and $F_{\nabla\lambda}(r_i)$ is Light weight feedback trust computation result of resource i.

The accuracy of the trust models is compared and the results are described by the authors. The result shows that T-Broker trust model provides the slightly smooth result among FTM (Fuzzy Trust Model) and STM (Subjective Trust Model), when we increasing and decreasing number of training samples from 50 to 500.

In [5], The *SMICloud* (Service Measurement Index Cloud) would let users compare different Cloud offerings, according to their priorities and along several dimensions, and select whatever is appropriate to their needs. Two main challenges tackled by this framework. First, how to measure various attributes. SMICloud used historical measurements and combined with promised values to find the actual value. Second, how to rank the service provider attributes. In SMICloud two types of QoS requirements are proposed. They are functional and non-functional. There are three layers available in this model. They are SMI Cloud Broker (receives customer's request and collects their requirements), Monitoring (discovers the cloud services and monitor their performance), and Service catalogue (store features advertised by cloud providers).Two types of parameters identified in this framework. One is qualitative and another one is quantitative. Thirteen quantitative factors are described in this model. Analytic Hierarchy Process (AHP) ranking mechanism is used for Multiple Criteria Decision Making.

Analytic Hierarchy Process - A method used to derive ratio scales from paired comparisons, which is developed by Prof. Thomas L.Saaty. In this process, if we have n parameters to compare, then n (n-1)/2 comparisons are made to rank the vendors.

Three phases used to prioritise the service providers. In first phase, QoS attributes are modelled in hierarchy structure. In second phase, relative weights of QoS attributes assigned by users are computed. Aggregation of relative ranking for attributes is calculated in the third phase. In SMICloud framework, Amazon EC2, Windows Azure and Rackspace cloud services performance are compared. User weights are randomly assigned from 1 to 9 for attributes and sub attributes. Relative Service Ranking Vector (RSRV) is calculated for each factor using its sub factors. This is the first framework to define all key performance metrics for QoS attributes and apply AHP-based ranking in Cloud computing to compare all type of cloud services.

In [9], Ranking Voting Method is proposed which is dynamic and flexible framework to rank the service provider. The parameters which are all not included in SMICloud framework like location of data centre, reputation of provider are added in this model to select IaaS service provider. The metrics are divided into application dependent metrics and user dependent metrics.

Ranked Voting Method – It s introduced by Tsuneshi Obata and Hiroaki Ishii. The metrics are considered as voter and the cloud providers are the candidates for them. Voter ranks the candidates n order of preference.

In [10], an approach is proposed to select software as a service product. Analytic Hierarchy Process (AHP) technique is used for prioritizing the SaaS product features. Three-part methodology is adopted. The first part covers the prioritization of parameters while second part is about product comparison. The third part combines the results obtained from first two parts to rank the products.

In SelCSP (Select Cloud Service Provider) framework [11], trustworthiness and competence are combined to estimate the interaction risk for customers. Before outsourcing data into cloud, not only quantitative factors are important but also qualitative factors like trust, competence, and reputation also important to estimate the provider. In this framework, trustworthiness is calculated from direct interaction and feedback rating of the service provider. From the transparency of SLA, competence is calculated. Three computations are available. They are (i) Trust estimation (ii) competence estimation (iii) risk calculation. The risk is calculated as follows.

$$R = R_p + R_r \quad (2)$$

Where R_r is relational risk and R_p is performance risk.

Exiting resource matching framework like Reservoir, pcmons, Rightscale and Spotcloud have problems like no monitoring of trust relationships and no learning mechanisms. So trust aware brokering architecture [12] is developed by Xiaoyong Li, Huadong Ma, Feng Zhou, and Xiaolin Gui. To select a provider they first consider whether the resource has the required capabilities (for example, CPU frequency, memory size, and hard disk capacity), and second, whether it is likely to complete the task successfully. Which are classified as application depended metrics and user depended metrics. For existing providers, an Adaptive Fused Computing approach is used for dynamic service operators which are based on information entropy theory. In this Brokering architecture four modules are described which are (1) Adaptive trust evaluation (2) Trusted resource matchmaking and distributing (3) Agent publish and service acquisition (4) Resource register. Trust is calculated based on availability, security, reliability attributes. To evaluate the trust degree of a cloud resource security levels are quantified as positive integers from 1 to 3. Global Trust Degree (GTD) is calculated for six cloud service providers. For newly registered providers, First Service Last Audit (FSLA) mechanism is used to overcome the trust initialization problem. The architecture is implemented using Eucalyptus framework and the KVM hypervisor. Accuracy is evaluated by comparing the related algorithms which are Weighted Average Trust Model (WATM) and Multi-dimensional Trust Model (MDTM). 1,500 training samples are used in this implementation.

The conceptual diagram and the table shows the different cloud provider selection models.

III. CONCLUTION

Cloud computing is an evolving paradigm, where choosing a trustworthy service provider is difficult thing for cloud customers. Nowadays a research is going on which investing customer preference to provide the best service. To choose an *ideal* (trustworthy & competence) service provider different parameters are considered by different selection framework model details. As for as of our knowledge, the existing models are used to calculate the trust and performance of the service providers.

No work was concentrated on finding risk of the service provider. So a framework for finding the risk on the service provider along with the trustworthiness, competence and quantitative

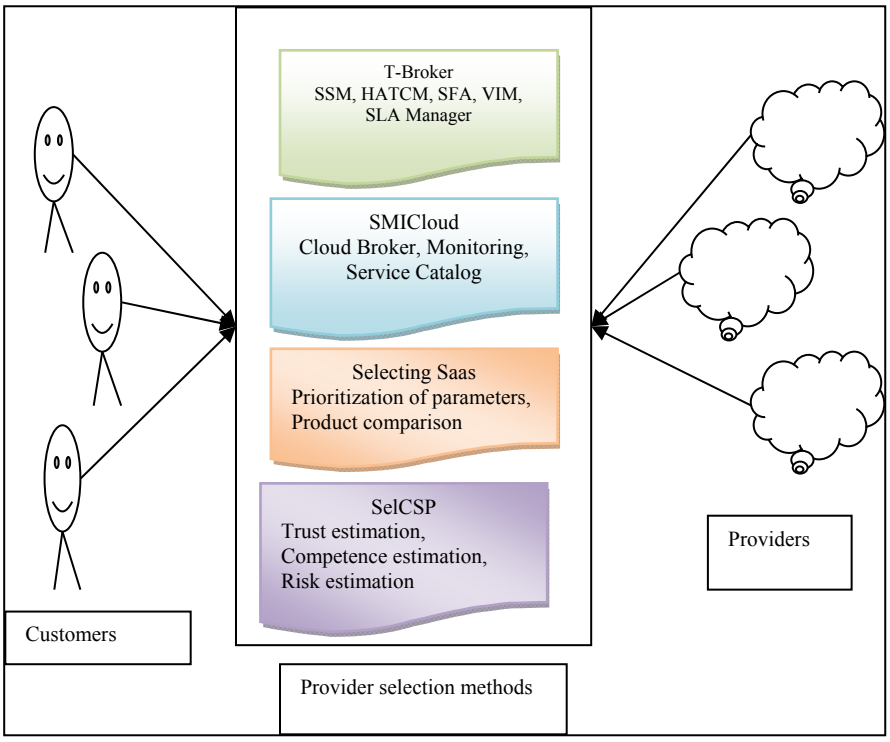

Fig 2.1: conceptual diagram of different models

PAPER NAME	METHOD USED	MERITS	DEMERITS
SMICloud: A Framework for Comparing and Ranking Cloud Services	AHP (Analytic Hierarchy Process)	Multi Criteria Decision Making	• Qualitative metrics not included. • Unavailable data will be randomly assigned. • Limitation of use of 9-point scale in AHP.
A Framework For Selection Of Best Cloud Service Provider Using Ranked Voting Method	Ranked Voting Method	Parameters like location of data centre, reputation of provider are added.	• Module or phase description not included. • Implementation details not included.
Approach for Selecting Software-as-a-Service (SaaS) Product	AHP (Analytic Hierarchy Process)	Deals with intuitive, rational /irrational, multi-objective, multi criteria decision making.	• The parameters weights are globalized and vendors are sorted. No specific calculation mechanism is available. • Limitation of use of 9-point scale in AHP.
Service Operator-Aware Trust Scheme for Resource Matchmaking across Multiple Clouds	Information Entropy Theory	Adaptability of the trust based on the current attributes of the providers.	• Reliability cannot be estimated using tradition mechanism like authorization & authentication. • Approximation of the entropy value between 0 and 1 value is complex
SelCSP: A Framework to Facilitate Selection of Cloud Service Providers	General trust vector scheme, State based reputation vector scheme.	Estimation of Risk is done prior to outsourcing business data onto the cloud.	• In implementation, only six cloud service providers included to evaluate the risk.
T-Broker: a Trust - Aware Service Brokering Scheme for Multiple Cloud Collaborative Services	Maximizing deviation method, Light weight feedback mechanism	System is Robust to deal dynamic number of service providers	• Trust is calculated based on particular attributes which are mostly needed for customers

Table 1: comparison of different selection models

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