J. Basic. Appl. Sci. Res., 3(2s)72-76, 2013
© 2013, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

A New Service Providers Selection System for Cloud Networks

Vahid Ashktorab[1], Dr. Kamran Zamanifar[2], Seyed Reza Taghizadeh[3*], Dr. Sayed Mehran Sharafi[4]

[1,2,4] Faculty of Computer Engineering, Azad Islamic University, Najafabad Branch, Esfahan, Iran
[3]Department of Information Technology, K.N.Toosi University of Technology, Tehran, Iran

Received: June 10 2013
Accepted: July 10 2013

ABSTRACT

In recent years, cloud computing growth has taken all the attention of various communities like researches, internet users, and government organizations. It reduced information technology overhead for the end-user, and total cost of ownership, and brought on greater flexibility, and on demand services. This concept, as a new kind of advanced technology, accelerates the innovation for the computer industry. This concept is based on the Internet, whose task is to ensure that users can simply use the computing resources. Users do not require any special knowledge about the concept of Cloud computing while using it. But before starting to use cloud services, they should choose between many service providers that are available nowadays. On the other hand, in this technologically growing world with lots of service providers and cloud services, it would be a difficult task for a user to choose between service providers. So a sever need of a Service Providers Selection System (SPS System) is felt. In this paper, we have proposed a method to select Service Providers in the best possible way, according to the cloud services that a user wants, and the priority of his/her needs. This selection is done by means of a service provider selection agent.

KEYWORDS*:* Service Provider Selection, Agent, SPS, Cloud Network, Cloud Services

1. INTRODUCTION

During the last years, the nature of the Internet was constantly changing from a place used to read web pages to an environment that allows end-users to run software applications. Interactivity and collaboration have become the keywords of the new web content. This new environment supports the creation of a new generation of applications that are able to run on a wide range of hardware devices, like mobile phones or PDAs, while storing their data inside the cloud [1,2]. Many applications such as word processing, spreadsheets, presentations, databases and more can all be done inside a web browser, while the software and files are housed in the cloud [4,14].

Cloud computing has shown to be a very effective paradigm according to its features such as on-demand self-service, broad network access from heterogeneous client platforms, and resource pooling to serve multiple consumers [4,14].

However, there are also some weak points such as security, availability and security issues. All of these issues and attribute should be taken into the consideration for each single Service Provider. The current cloud computing architecture involves the existence of service providers that are able to provide these services to the clients located all over the world. In this context, the cloud can be seen as a unique access point for all the requests coming from the customers/clients [6,8]. But choosing between these many service providers seems to be a badgering task [3]. In this paper, we have first introduced the cloud computing briefly. Then in chapter 2 we have introduced Cloud Architecture, service models and deployment methods. Chapter 3 is dedicated to our proposed approach for choosing a service provider. After that, a numerical example is presented in chapter 5, this numerical example shines a light upon the way our propose method works in reality. Finally, chapter 6 concludes that paper.

2. CLOUD COMPUTING DEPLOYMENT MODELS AND SERVICE MODELS

The cloud deployment model is composed of four deployment models: private cloud, community cloud, public cloud, and hybrid cloud. Here is a definition for each deployment model.

•**Public Cloud** – The cloud infrastructure is provisioned by the cloud provider for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them, and allows them to pay for what they use [13]. It lowers the IT costs but is exposed to more serous attacks than another models [12].
•**Private Cloud** – Infrastructure provisioned solely for a single organization, whether managed internally or by a third-party and hosted internally or externally [6].
•**Community Cloud** – Shares infrastructure between several organizations from a specific community with common concerns (e.g., security, compliance, jurisdiction), whether managed internally or by a third-party and hosted internally or externally [5,16].

Corresponding Author: Seyed Reza Taghizadeh, Department of Information Technology, K.N.Toosi University of Technology, Tehran, Iran. +989197073239 s-rezataghizadeh@sina.kntu.ac.ir s.rezataghizade@yahoo.com

•**Hybrid Cloud** – A composition of two or more clouds (private, community, or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models [11,15]. It can also be defined as multiple cloud systems that are connected in a way that allows programs and data to be moved easily from one deployment system to another [7,10].

There is also another model which is cited as "Virtual Private Model". This model was at first introduced by Amazon [9]. This kind of service providers are an invisible bridge between the organization and public cloud of Amazon [8].

There are also different perspectives for the services presented by cloud service providers. These prospective are described below:

•**Software as a Service (SaaS)** - SaaS supports a software distribution with specific requirements. Users can access an application and information remotely. They pay only for that they use. Sales force is one of the well-known providers in this scope. Microsoft's Live Mesh also has a sharing mechanism for files and folders across multiple devices in the same time. SaaS employs the provider's applications that run on a cloud infrastructure. The provider manages or controls the underlying cloud infrastructure with the possible exception of limited user-specific application configuration settings [11,7].

•**Platform as a Service (PaaS)** - PaaS provides a suitable environment for building, testing and deploying custom applications. The cloud infrastructure which is supposed to make it possible for crested or acquired applications to be deployed. The consumer has control over deployed applications and possible configuration settings for application-hosting environment [13]. The best examples of PaaS are Google App Engine, and Microsoft Azure,

•**Infrastructure as a Service (IaaS**) - IaaS layer is on the top of data center layer. It enables the procurement of storage, hardware, servers and networking components. The client pays only for the services that he/she uses. Hence clients can save cost. Consumers are able to deploy and run arbitrary software, which can include operating systems and applications [14]. In this model, infrastructure can be expanded dynamically according to level of necessity. The best examples of this type of service are Amazon EC2 and Simple Storage Service.

3. SERVICE PROVIDER SELECTION SYSTEM (SPS SYSTEM)

Both the functionality and the structure of a service provider selection system may vary from highly to loosely integrated level. The highly integrated service provider selection systems generally have fairly complex internal and external operations. They might have many users, spread all over the world, who demand a large variety of services. In order to respond these demands in the best possible way a SPS system that efficiently and effectively link-up complex operations should be installed.

The advent of new information systems and technologies (IS and IT), Internet, Intranet, and Extranet, in particular, inter-organizational communication and coordination mechanisms has created unprecedented opportunities for SPS systems.

3.1 The SPS agent for control and optimization

An agent is a technical system that supports the transactional relationship within the network of service providers. We will describe the functionality of this selection agent (SA).

The agent plays the most important role in our proposed SPS system. It mediates the interaction between service providers and users in our SPS system. The agent is especially useful when a supply chain system has many users and service providers. It is helpful when the search cost is relatively high and much of the users pay attention to different aspects of a service provider.

3.2. Service Provider (SP) Profile

In this paper we have suggested a central manager who has the detailed information about all service providers. This information is kept in form of tables in the way that each table has several rows, known as selection criteria, with a weight in front of each row, indicating the strength of the service provider in that criterion. The agent receives from SP manager all necessary information about the quantitative and qualitative attributes related to each service provider. After that, the agent designs the SP-keyword incidence matrix as $SKIM=[r_{ij}]$, where r_{ij} represents the fuzzy value of i^{th} Service Provider on j^{th} attribute. This value indicates the priority of a specific service provider to satisfy a specific need of a user.

On the basis of a specified threshold value for each key term the above matrix could be converted to a binary matrix $BSKIM= [br_{ij}]$, where $br_{ij} = 1$ if $r_{ij} \geq \alpha_j$ and $br_{ij} = 0$ otherwise. α_j is the threshold value of keyword j. We can also obtain the weight of each attribute using the formula **(1).**

$$w_j = \frac{\sum_i br_{ij}}{\sum_i \sum_j br_{ij}} \qquad \textbf{(1)}$$

This value helps us to understand the real state of our provider in a specific attribute, and hence a good criterion to how to form our expectancy from attributes weights of providers. On the basis of this weight we modify the *SKIM* matrix to obtain the SP profile matrix as given in formula **(2).**

$$WSKIM = SKIM \times \lfloor w_j \rfloor \qquad \textbf{(2)}$$

Where $\lfloor w_j \rfloor = \begin{bmatrix} w_1 & 0 & 0 & \cdots & 0 \\ 0 & w_2 & 0 & \cdots & 0 \\ . & & & & . \\ . & & & & . \\ . & & & & . \\ 0 & 0 & 0 & \cdots & w_n \end{bmatrix}$

3.3. User Profile

Another segment of this agent is User Profile. To form this profile, agent should have a good understanding of different user needs. These pieces of information are provided by SP manager. When a user consult SP manager to find his/her appropriate service provider, SP manager asks him/her to fill a specific form, known as application form, so that he can know the user expectancies from a service provider better. By filling the application form, SP manager recognizes what the user want, and to what degree. By obtaining all information about users, agent creates the service provider-keyword incidence matrix. The agent designs the service provider-keyword incidence matrix as $UKIM = [s_{ij}]$, where s_{ij} represents the value of a user on the corresponding need.

On the basis of a specified threshold value for each key term the above matrix could be converted to binary matrix $BUKIM = [bs_{ij}]$, where $bs_{ij} = 1$ if $s_{ij} \geq \beta_j$, and $bs_{ij} = 0$ otherwise. β_j is the threshold value of the key term *j*. Then we obtain the weight of each key term as shown in the formula **(3).**

$$w_j = \frac{\sum_i bs_{ij}}{\sum_i \sum_j bs_{ij}} \qquad \textbf{(3)}$$

With this weight we modify the *UKIM* matrix to obtain the user profile matrix as *WUKIM* matrix as shown in formula **(4)**.

$$WUKIM = SKIM \times \lfloor w_j \rfloor \qquad \textbf{(4)}$$

3.4. SPS Profile

The match between service providers and users is obtained using formula **(5)**.

$$MSU = WSKIM \times WUKIM^T = [sp_{ij}] \qquad \textbf{(5)}$$

The above matrix introduces the suitability of each of service providers for users in an environment of a SPS system.

On the basis of a specified threshold value we can convert the above matrix into a modified matrix $BMSU = [bsp_{ij}]$, where $bsp_{ij} = 1$ if $sp_{ij} \geq \theta$, otherwise $bsp_{ij} = 0$. θ is the threshold value.

3.5. Feasibility Analyzer

With feasibility analyzer and considering the feasibility structure, we convert the *BMSU* matrix to a Decision Matrix Supply Chain $DMSR = [dsr_{ij}]$, where $dsr_{ij} = 1$ if $bsp_{ij} = 1$ and *feasible*, otherwise $dsr_{ij} = 0$. Then we use this matrix in the transportation model as illustrated in the next section.

4. SIMPLE IMPLEMENTATION & NUMERICAL EXAMPLE

As we have earlier mentioned that each service provider has some attributes, which show the degree of his capability to satiate s specified user need. We suppose here that a value is set to each capability of service provider, which varies between 0 and 9. Bigger number means more of Service Provider in that attribute. On the other hand, the agent has also set a value for each requirement of each user. These values are set according to the application forms, filled by the user. These values also vary between 0 and 9. Here, we show the process in form of a numerical example. In our example we

have 4 service providers, and 4 user profiles. Each oh these service providers has 6 attributes and accordingly each user has 6 requirements. The assigned numbers are shown in table below. In this table, SP stands for Service Provider.

Table 1: Service providers and their attributes

	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5	Attribute 6
SP 1	1	2	7	5	1	4
SP 2	2	3	6	8	0	3
SP 3	3	4	2	2	7	7
SP 4	4	1	1	5	9	2

So the UKIM matrix is defined as:

$$\text{SKIM: } \begin{bmatrix} 1 & 2 & 7 & 5 & 1 & 4 \\ 2 & 3 & 6 & 8 & 0 & 3 \\ 3 & 4 & 2 & 2 & 7 & 7 \\ 4 & 1 & 1 & 5 & 9 & 2 \end{bmatrix} \quad \textbf{(6)}$$

On the other hand, we have the requirements of users in form of table 2. Each number shows that to what degree a user wants a requirement to be satisfied. In this table, U stand for User.

Table 2: Users and the degree of their needs to each requirement

	Requirement 1	Requirement 2	Requirement 3	Requirement 4	Requirement 5	Requirement 6
User1	1	3	4	1	3	6
User2	1	2	5	0	9	5
User3	2	7	4	9	3	4
User4	5	1	6	7	2	3

By means of this table, UKIM matrix can be defined as follow:

$$\text{UKIM} = \begin{bmatrix} 1 & 3 & 4 & 1 & 3 & 6 \\ 1 & 2 & 5 & 0 & 9 & 5 \\ 5 & 7 & 4 & 9 & 3 & 4 \\ 2 & 1 & 6 & 7 & 2 & 3 \end{bmatrix} \quad \textbf{(7)}$$

Now we use (6) and (7) to calculate $W_{j\,(SP)}$ and $W_{j(User)}$

$$W_{j\,(SP)} = \begin{bmatrix} 0.11236 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.11236 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.179775 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.224719 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.191011 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.179775 \end{bmatrix} \quad \textbf{(8)}$$

$$W_{j(User)} = \begin{bmatrix} 0.096774 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.139785 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.204301 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.182796 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.182796 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.193548 \end{bmatrix} \quad \textbf{(9)}$$

In the next step we should calculate Weighted matrices of UKIM and SKIM. These two matrices are calculated according to equation (4)

$$\text{WUKIM} = \begin{bmatrix} 0.11236 & 0.224719 & 1.258427 & 1.123596 & 0.191011 & 0.719101 \\ 0.224719 & 0.337079 & 1.078652 & 1.797753 & 0 & 0.539326 \\ 0.337079 & 0.449438 & 0.359551 & 0.449438 & 1.337079 & 1.258427 \\ 0.449438 & 0.11236 & 0.179775 & 1.123596 & 1.719101 & 0.359551 \end{bmatrix} \quad \textbf{(10)}$$

$$\text{WSKIM} = \begin{bmatrix} 0.096774 & 0.419355 & 0.817204 & 0.182796 & 0.548387 & 1.16129 \\ 0.096774 & 0.27957 & 1.021505 & 0 & 1.645161 & 0.967742 \\ 0.193548 & 0.978495 & 0.817204 & 1.645161 & 0.548387 & 0.774194 \\ 0.483871 & 0.139785 & 1.225806 & 1.27957 & 0.365591 & 0.580645 \end{bmatrix} \quad \textbf{(11)}$$

And finally we compute MSU matrix according to equation (5)

$$MSU = \begin{bmatrix} 2.278724 & 2.369337 & 3.779993 & 3.553461 \\ 2.999517 & 1.739761 & 4.629938 & 4.091579 \\ 2.791712 & 3.943095 & 3.245741 & 2.461278 \\ 3.803191 & 3.434699 & 3.413435 & 3.728525 \end{bmatrix}$$

This is the final matrix which each of its rows corresponds to one of service providers, and each column corresponds to one User. In this matrix, the biggest number in each column shows the most suitable service provider for that user. Table 3 shows this relation between service providers and users. For example best SP for User 1, is the SP 4 . In this table, SP stands for Service Provider.

Table 3: Best Service Provider for each User

	User 1	User 2	User 3	User 4
SP 1	0	0	0	0
SP 2	0	0	**1**	**1**
SP 3	0	**1**	0	0
SP 4	**1**	0	0	0

5. Conclusion

Due to the diverse functionality and complexity of SPS systems, we introduced a new service provider selection system. An agent is designed to facilitate the preprocessing of data on SP attributes as well as user views. The basic information is obtained in the form of service provider-keyword incidence matrix to achieve service provider profile. The service provider profile is designed to study the possibility of interaction between two major actors, service providers and users.

The interaction between two profiles has been derived to illustrate the profile.It presents a great potential to resolve several aspects of real-world SPS systems which generally face with problems when they want to cooperate with each other. This research provides a reliable and dynamic structure of service provider selection that can improve user performance.

To understand the effects of the variations in the threshold values, α_j,β_j and θ , we could perform suitability analyses and create weights to obtain corresponding profiles.

REFERENCES

[1] DeCoufle B., The impact of cloud computing in schools, The Datacenter Journal, July 2009
Vipul Jain a, S.G.Deshmukh b a Mechanical. Dynamic supply chain modeling using a new fuzzy hybrid negotiation mechanism
[2] Cena F., Farzan R., Lops P., Web 3.0: Merging Semantic Web with Social Web, *Proceedings of the 20th ACM conference on Hypertext and hypermedia*, HT'09, June 29–July 1, 2009, page 385
[3] Boja C., Batagan L., Software Characteristics of M-Learning Applications, *Proc. of. 10th WSEAS International Conference on Mathematics and Computers in Business and Economics*, Prague, Czech Republic, March 23- 25, 2009, pp. 88-93;
[5] Creeger M., CTO Roundtable: Cloud Computing *Communications of the ACM*, vol. 52, no. 8, august 2009, pp. 50-56
[6] Sedayao J., "Implementing and Operating an Internet Scale Distributed Application using Service Oriented Architecture Principles and Cloud Computing Infrastructure," *iiWAS2008*, Austria, pp. 417-421, 2008.
[7] K. Wood and M. Anderson, "Understanding the Complexity Surrounding Multitenancy in Cloud Computing," in *e-Business Engineering (ICEBE), 2011 IEEE 8th International Conference on*, 2011, pp. 119-124
[8] I. Foster, Y. Zhao, I. Raicu, and S. Lu, "Cloud Computing and Grid Computing 360-Degree Compared," in Proceedings of Workshop on Grid Computing Environments (GCE), pp. 1, January 2009.
[9] C. Vecchiola, X. Chu, and R. Buyya, "Aneka: A Software Platform for .NET-Based Cloud Computing," Journal on Computing Research Repository (CORR), pp. 267 - 295, July 2009.
[10] K. Stanoevska-Slabeva, T. Wozniak, S. Ristol, "Grid and Cloud Computing Abusiness Perspective on Technology and Applications, Springer, ISBN: 978-3-642-05192-0, 2010.
[11] National Institute of Standards and Technologies; Draft NIST Working Definition of Cloud Computing, May 14, 2009
[4] The Open Group, The Open Group Architecture Framework (TOGAF), Definition of the term "Architectural Principle".
[13] G. H. Forman and J. Zahorjan,"The Challenges of Mobile Computing," IEEE Computer Society Magazine, April 1994.
[14] R. Kakerow, "Low power design methodologies for mobile communication," in Proceedings of IEEE International Conference on Computer Design: VLSI in Computers and Processors, pp. 8, January 2003.
[15] A. Ghazizadeh, "Cloud Computing Benefits and Architecture in E-Learning," in *Wireless, Mobile and Ubiquitous Technology in Education (WMUTE), 2012 IEEE Seventh International Conference on*, 2012, pp. 199-201.