REVIEW OF RESEARCH

IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X

VOLUME - 8 | ISSUE - 4 | JANUARY - 2019

REVIEW OF SERVICE LEVEL AGREEMENTS IN MULTI CLOUD ARCHITECTURE FOR QUALITY OF SERVICES

D.V.Bhavsagar[1], Dr. Vinay Chavan[2] and Dr. S. J. Sharma[3]

[1]Assistant professor, Department of Computer Science, S. K. Porwal College, Kamptee(Nagpur).

[2]Associate professor and H.O.D, Department of Computer Science,S. K. Porwal College, Kamptee(Nagpur).

[3] Professor and H.O.D, Department of Electronics R.T.M. Nagpur University, Nagpur.

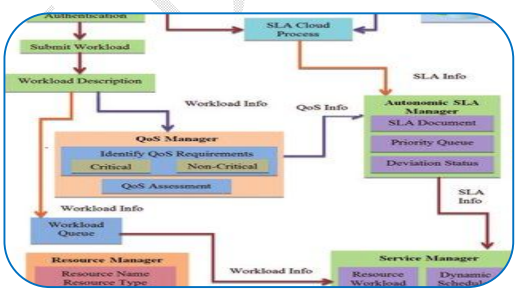
ABSTRACT :

Enterprises look multiple clouds computing to meet need of quality of service, optimize service cost, free migration to various service providers and vender lock-in. Since in multi cloud storage a single file distributed on several cloud service provider, in order to use the file user need to retrieve it from multiple provider. User must know the expected uptime or down time of system from where the file is going to be fetched and has sign an agreement with multiple CSPs. This is the main obstacle for enterprises to take advantage of multi cloud. To face this obstacle there is need to generate SLA for multi cloud frame work. In this paper we reviewed SLA of various multi cloud architecture and identified essential parameter required to generate SLA. As SLA decide responsibilities, scope and quality of service, SLA measure performance of CSPs in multi cloud. The SLA must also specify a plan to address down time of system and handle customer in case of contract breach or compensation for the customer. In this paper we also studied various operation research techniques and statistical method like MCDM, TOPSIS and VIKOR to design SLA but yet there is need to established mechanism to measure performance and identify parameter for various combinations of CSPs for multi cloud.

KEYWORDS : *Service Level Arguments, Multi-Cloud Architecture, data availability, Quality of Service, Service Provider, Multi Criteria Decision Making (MCDM), Service Measurement Index, Cloud Infrastructural Services.*

I. INTRODUCTION

A standardized service contract is called as a service level agreement where the services provided are formally defined. There is a need to sign an agreement between the service user and service provider to decide the responsibilities scope and quality of the service providers. Deciding the delivery time of the service or performance is the main feature of SLA. Considering the example of an SLA signed between internet service provider and telecom the common features which need to be decided are Mean Time To Repair or Mean Time To Recovery (MTTR), Mean Time Between Failures (MTBF), identifying which party needs to pay fees, report faults, decided data rate, through put and many more measurable parameters



There are different levels of SLAs. Even though they originated with network service provider however presently they have become popular with telecommunications service providers and cloud service providers SLAs measure the performance of CSPs using various parameters. To name a few application response time, informing the changes in network in advance, which may affect the users. Metrics like availability and uptime usage statistics, no of concurrent users which can be served or some specific performance benchmarks to which the performance needs to be compared periodically. Just establishing the performance metrics is not sufficient. The SLA must also specify a plan for addressing downtime and handle the customers in case of contract breach or compensation for the customers. These SLAs are meant for a single cloud service provider. In case of Multi-Cloud storage approach a single file gets distributed on several CSPs. For using the file the user needs to retrieve it from multiple CSP's. Hence, the user must know the expected uptime or downtime of the system from where the file is going to be fetched and he has to sign an agreement with multiple CSPs. This reason is stopping the enterprises to make use of the Multi-Cloud frameworks. Therefore there is a need to generate master SLA to promote migration to Multi-Cloud. People select the CSPs based on the loss or gain incurred rather than the final outcome. Even the Service providers need to make decisions in the construction of Federated Cloud, Composite Cloud and Multi-Cloud frameworks as to which CSPs should be the part of the framework based on the user requirements. One approach to provide solution to this problem is the Multi Criteria Decision Making approach.

Researchers like Chen et.al. have applied different MCDM methods in fields of manufacturing, computer science and so on. This paper also categorizes fuzzy MCDM into three types based on approaches to find rankings, approaches to access the relative importance of multiple attributes and fuzzy mathematical programming. Author has even discussed five methods of Fuzzy Multiple Attribute Decision Making (FMADM), namely, fuzzy simple additive weighting methods, analytical hierarchy process, fuzzy conjunctive / disjunctive methods, fuzzy outranking methods, and maxi-min methods. Author of paper [1] has done comparative study of de-fuzzification methods.

Normalization is important step in all MCDM techniques. Normalization methods influence accuracy of final results. Various normalization methods are proposed based on vector transformation, linear transformation and non-linear transformation theories. Many researchers have presented research work on SLA QoS based service selection in Web Service and Cloud Computing domain using different MCDM methods [2, 3, 4, 5, 6, 7, 8, 9]. Most of the research work in application of MCDM methods in cloud computing is restricted to selection of single service providers based on ranking or multiple attribute decision making methods. A few of the researchers have presented work on Multi-Cloud environment, but they have not provided any solution related to aggregate functions for implementation details of Multi-Cloud [10]. Garget al. have proposed framework, which compares different cloud providers based on user requirements by ranking cloud providers using AHP MADM method, Service Measurement Index (SMI) attributes are considered for ranking cloud providers. SMI Cloud is designed for selection of single cloud for deployment of user application. Basically it is designed for Software- as-a-Service [7].

II. VIKOR METHOD

Alaboolet al. have used Fuzzy modified Vlse Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method to select service provider based on trust [11]. Both TOPSIS and VIKOR methods rank service providers based on positive ideal solution and negative ideal solution. Main difference between these two methods is the way in which positive ideal and negative ideal values are selected. One of the evolving software engineering processes is evaluating and selecting the cloud Infra structure service based on trust criteria. There is a great uncertainty and complexity in providing trust worthiness by the Cloud Infrastructure Services (CIS). There are various normalization methods to develop cost effective solutions. One of the approaches to deal with trust criteria is the hybrid fussy Multi-Criteria group decision making method based on combined fuzzy set and modified VIKOR method. This solution basically deals with conflicting and in commensurable criteria. This helps the cloud user to decide which CSP will meet their trust requirements before deploying the applications, files and data to the cloud. This also provides guidance to CSPs to prioritize the enhancement actions to the CIS in order to fill the gaps to achieve the required trust level. Ye et al. have used graphical model Influence Diagram for selecting best composition for service [12]. Karim et. al. Have proposed approach for selection of single cloud based user requirement at SaaS layer and then map these SaaS layer requirement to IaaS layer attributes to select best IaaS service providers. Authors of both [7] and [13] while considering the Measurement methods has assumed that all cloud providers follow same methods. Aggregation functions are derived by combining corresponding SaaS and IaaS attributes measurement methods.

III. HS4MC ARCHITECTURE

Approach HS4MC, rank both single service provider and composite cloud service. HS4MC approach assists Software as a Service provider to select the best cloud infrastructure service considering user satisfaction factor. Automatic service selection by considering SLA claims of SaaS providers is proposed in HS4MC. The uniqueness of this approach is the use of prospect theory for ranking the service providers. This theory is used to rank the services by comparing the scores given to these services by other users called as user preferences. This approach based on the SaaS provider requirements which differ from individual set of providers constructs the set of SLAs. The services best suited for the constructed SLAs are selected.Using various services from multiple Clouds to have a wide range of choices with various cost and quality of services (QoS) can be viewed as a natural evolution in Cloud computing. There are several reasons to utilize multiple Clouds such as: improving the quality of service, while optimizing service cost; migrating among various providers and avoiding vendor lock-in. There are two types of delivery models for multiple Clouds: Federated Cloud and Multi-Cloud. Service delivery systems are managed through the SLA management process to meet the QoS objectives specified in the SLA. In the SaaS provider scenario, it is necessary to specify and manage SLAs in two layers: an SLA between the SaaS customer and the SaaS provider that reflects the QoS objectives of the offered services to the customer, and an SLA between the SaaS and the Infrastructure-as-a-Service (IaaS) provider, which implicitly affects the customer satisfaction.

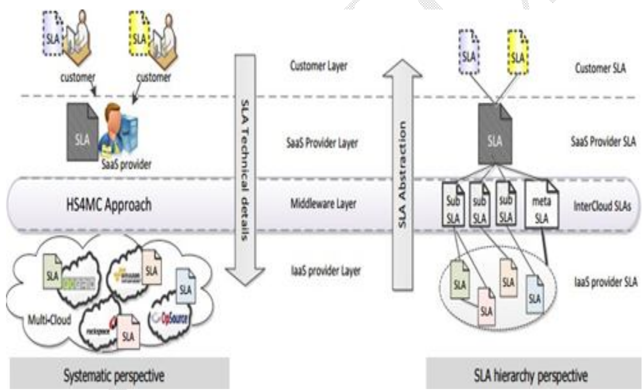


Fig. 1 SLA hierarchy and service diversity in Multi-Cloud[14]

The systematic perspective of figure 1 represents the position of HS4MC approach given in [14]. It placed between the SaaS and IaaS provider layers which handling the SLA heterogeneity and service selection. HS4MC proposes the concept of sub-SLA and meta-SLA as Inter-Cloud SLAs to be able to cover the requirements of the SaaS provider for the Composite Infrastructure Service as well as each included service. In HS4MC approach, the focus is on the SLA between a SaaS and an IaaS provider which includes both functional and non-functional parameters. Each non-functional parameter in an SLA can be considered as hard or soft. Hard parameters must be satisfied, e.g. the infrastructure cost must be less than a specific amount, while satisfaction of soft parameters is not mandatory but preferred, that response time is to be less than 5s. By SLA satisfaction, we mean providing functional and hard non-functional parameters as well as trying to find the most suitable services for the soft ones.

In HS4MC there are two phases: SLA Construction and Service Selection, which are described in this section. Fig 2 depicts the HS4MC architecture and the included phases along with the input and output of each phase

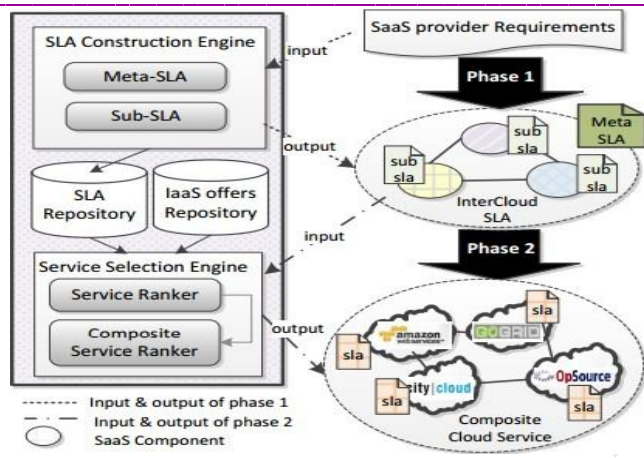


Fig 2 HS4MC architecture and phases [14]

A. SLA Construction Phase

This phase need as an input where SaaS provider submits its cloud infrastructure requirements to the SLA construction engine as a single XML file. These requirements contain two abstract parts: one including the requirements for each infrastructure component (Cloud virtual machine (VM) or storage), and the other enfolding the requirements of the whole set of requested infrastructures. The SLA Construction Engine extracts the data related to these two parts and constructs a set of sub SLAs as well as a meta-SLA by utilizing SLA ontology. The main purpose of constructing such SLAs, named InterCloud-SLA2 is to address the SLA interoperability issue in Multi-Cloud. Fig 3 presents this process by considering the SLA hierarchy perspective. Namely, the SLA Construction Engine needs some sort of data-connection and reasoning ability in order to break down the SaaS requirements in a way that they can be mapped to the current service offers and combine current offers in order to provide new value- added services for the user requirements.

B. Service Selection Phase

The two inputs of this phase are the inter-cloud SLA's and the IaaS providers as shown in fig 3. A ranking list of each sub-SLA is created by the service ranker component. The output of this component is given as an input to the Composite service Ranker. These components rank these combinations of services for the meta SLA. Hence the output of this ranking will be the best score amongst all the candidates. The proposed ranking methodology is explained with the Computer Aided Design (CAD) service provider scenario.

The CAD-aaS provider wants to deploy the various components of its CAD service, presented in Fig 3 in Cloud, since it request several Cloud infrastructure services it require one small VM and one large VM for the application User Interface (UI) and GPU features for the computation component respectively . It also requires 100GB of storage to store the CAD models.

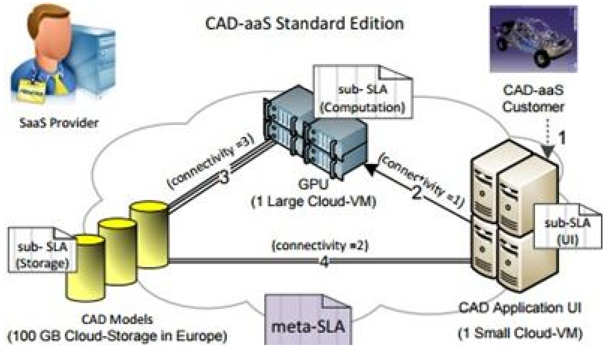


Fig 3 Composite infrastructure service for a CAD-aaS standard edition

IV. TOPSIS METHOD

The cloud TOPSIS method is used to exploit the complexity and uncertainty with various CSPs [15]. Like humans the CSP's have both fuzziness and randomness which cannot be dealt with a traditional approach. Here the author has defined positive ideal cloud and negative ideal cloud. Later Yao et. al. has proposed an algorithm to select an optimal set of CSPs to form Multi-Cloud from the set of available CSP's using Information Dispersal Algorithm (IDA) [16]. However this algorithm selects the CSPs considering parameters like algorithm cost, vendor lock-in, transmission performance and data availability.

The features of IT provisioning model of cloud like multi-tenancy, virtualization and resource sharing raise certain difficulties in billing estimation during the design and deployment of the applications. There is no benchmarking process for measuring the performance of CSP's. Mechanisms for measurement of performance of CSP's for various deployment models like Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Data Storage as a Service (DaaS), etc differ. This is due to the varied parameters considered in their measurement. For eg: Heterogeneous and unknown hardware resources available for SaaS deployment. They may differ in number of cores, memory sizes and disk quotas. This may result in variation between fast instance and slow instance between the ranges of 40% to 60%. Hence in this paper authors have made an effort to design a mechanism to benchmark the application level workload characterization. For demonstration they have made use of three large commercial cloud providers, Microsoft Azure, Amazon Elastic Compute Cloud (Amazon EC2) and Flexiant. Parameters considered for ranking are cost, performance and workload.

V. CONCLUSION

In this paper we reviewed operation research technique using MCMD method, also categorized MCDM into MODM and MADM for design SLA for multi cloud. In all MCDM method normalization is important factor, so perform critical analysis of various normalization methods. Usage of MCDM is restricted to selection of single service provider based on ranking or multiple attribute decision making method. Very few researchers worked on multi cloud environment but not provide solution to aggregate function for implementation of multi cloud. SLA are generated for single cloud service provider on SaaS and IaaS model but it is found that measurement method of the attribute may differ in most of commercially available service provider as they have their own method to measure attributes. HS4MC approach used prospect theory and linear Max-Min normalization function to generate SLA for SaaS model. However the result of ranking different CSPs are need to compared with other normalization techniques and design SLA for IaaS and DaaS. Researcher used TOPSIS method to analyzed complexity and uncertainty with distinct CSPs, categorized cloud into positive and negative ideal cloud. By using IDA propose multi cloud framework, by selecting optimal set of available CSPs. However there is need to established mechanism to measure performance and identify parameter for various combinations of CSPs for multi cloud.

REFERENCES

[1] H. Deng and C. Yeh, "Simulation-based evaluation of de-fuzzification based approaches to fuzzy multi-attribute decision making," IEEE Transactions on Systems, Man, and Cybernetics, Part A: Systems and Humans, vol. 36, no. 5, pp. 968-977, Sept. 2006.

[2] F. Angus, C. Huang, W. Lan, and J. Stephen, "An optimal QoS-based Web service selection scheme," Information Sciences, vol. 179, no. 19, pp. 3309- 3322,Sept 2009.

[3] T. Lin, "Service selection algorithms for Web services with end-to-end QoS constraints," in Proceedings of IEEE International Conference one-Commerce Technology,(CEC 2004). , vol. 3, San Diego, CA, USA, July 6-9, 2004, pp. 129 - 136.

[4] M. Alrifi, T. Rissie, and P. Dolog, "A Scalable Approach for QoS-based Web Service Selection, "Service oriented computing, vol.5472, pp.190-199,2008.

[5] C. Makris,Y. Panagis,E. Sakkopoulos V. Diamadopoulou, "Techniques to support Web Service selection and consumption with QoS characteristics," Journal of Network and Computer Applications, vol. 31, no. 2, pp. 108– 130, Apr. 2008.

[6] M. Luhandjula, "Fuzzy Mathematical Programming: Theory, Applications and extention," Journalof Uncertain Systems, vol. 1, no. 2, pp. 124-136, Jan. 2007.

[7] S. Garg, S. Versteeg, and R. Buyya, "SMICloud: A Framework for Comparing and Ranking Cloud Services," in Proceedings of Fourth IEEE International Conference on Utility and Cloud Computing (UCC), Victoria, NSW, Dec 5-8 , 2011, pp. 210 -218.

[8] E. Wittern, J. Kuhlenkamp, and M. Menzel, "Cloud Service Selection Based on Variability Modeling," in Service oriented computing.: Springer, 2012, pp. 127– 141.

[9] M. Haque,M. Chowdhury,A. Gani M. Whaiduzzaman, "A Study on Strategic Provisioning of Cloud Computing Services," The Scientific World Journal, pp. 1- 16, 2014.

[10] R. Ko, and P. Jagadpramana, "Trust-Cloud: A Framework for Accountability and Trust in Cloud Computing," in Proceedings of IEEE World Congress on Services (SERVICES), Washington, DC, USA, July 4-9 , 2011, pp. 584- 588.

[11] Farokhi S, Jrad F, Brandic I, Streit A (2014) Hierarchical SLA-based service selection for multi-cloud environments. In: 4th International Conference on Cloud Computing and Services Science, pp 722–734

[12] Justice Opara-Martins, Reza Sahandi, and Feng Tian. Critical review of vendor lock-in and its impact on adoption of cloud computing. In Information Society (i-Society), 2014 International Conference on, pages 92–97. IEEE, 2014.

[13] C. Wang, Q. Wang, and W. Lou, "Privacy-Preserving Public Auditing for Data Storage Security in Cloud Computing.," in Proceedings of the 29th IEEE Conference on Information Communications (INFOCOM'10), San Diego, CA, Mar 15-19, 2010, pp.525-533.

[14] Sehgal, N., Sohoni, S., Xiong, Y., Fritz, D., Mulia, W., & Acken, J. (2011). Cross Section of the Issues and Research Activities Related to both Information Security and Cloud Computing. IETE Technical Review, 28(4), 279-291. https://doi.org/10.4103/0256-4602.83549

[15] Zissis, D., & Lekkas, D. (2012). Addressing Cloud Computing Security Issues. Future Generation Computer Systems, 28, 583-592. https://doi.org/10.1016/j.future.2010.12.006

[16] S. Kamara, K. Lauter, "Cryptographic cloud storage", Proc. Financ. Cryptography Data Secur., pp. 136-149, 2010.

D.V.Bhavsagar
Assistant professor, Department of Computer Science, S. K. Porwal College, Kamptee(Nagpur).