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Performance of Multiple Cloud Service Provider Ranking Approaches based on Service Measurement Index (SMI)

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Abstract: ***Cloud computing is a promised upward model that offers cost effective outsourcing services to the users on demand and on basis of pay per utilization. Cloud computing users always have applications with different resource requirements. On the other hand, there are different cloud Service providers which present services with different qualitative characteristics are available. Single cloud environment has unable to produce effective results during peak load. Determining the best cloud computing service for a specific application is a serious problem for users. Cloud Service Measurement Index Consortium (CSMIC) has identified some metrics in the form of Service Measurement Index (SMI) that helps to evaluate and compare the services of different cloud providers. Ranking the cloud service providers based on these SMI metrics is a not easy task because the value of the metrics determined and selected. Ranking compares the different services offered by different providers based on quality of services with the support of Service Level Agreement (SLA) also. In this paper, a new framework for cloud that maintains the SLA by means of distinguished the incoming requests either SLA based member or SLA based non-member the existing approaches for ranking cloud computing services are analyzed.***

Keywords: SMI, Service providers, SLA, Ranking mechanism, Virtual Machine.

I. INTRODUCTION

Cloud computing is a new cost-effective paradigm for delivery of applications, platforms, or computing resources to customers in a "pay-as-you-go-model". SaaS layer allows customers to access applications over the Internet without software related cost and effort (such as software licensing and upgrade).General objective of SaaS providers is to minimize cost includes the infrastructure cost, administration operation cost and penalty cost caused by SLA violations and maximize customer satisfaction level (CSL).[2]SaaS providers utilize internal resources of its data centres or rent resources from a specific IaaS provider. In-house hosting can generate administration and maintenance cost while renting resources from a single IaaS provider can impact the service quality offered to SaaS customers due to the variable performance. To overcome the above limitations, multiple IaaS providers and admission control are considered that brings huge amount of resources, various price schemas, and flexible resource performance to satisfy the SLA. Admission control is defined as a validation process in communication systems mechanisms to avoid overloading of resources and SLA satisfaction

Cloud Computing user model provides services and deliver on demand various resources (such as Software, Infrastructure, Desktop, Anything(X) and Platform as a Service [16, 2]) in user's request time. This computational user model has been developed like other utilities such as gas, electricity and water, it can be considered as the next effectiveness required for human being life. In this environment each user has its own some unique prerequisite. Thus, selecting the best service that satisfying user's application requirements is an important research challenge [3]. The usage of service usually determines the success of its application infrastructure. The Service provider's facility cannot be fully utilized by selecting the wrong services [4-7]. The Quality of Service (QoS) information is required in service assessment. This information can be considered by providers or a third party [4]. Some attributes like cost, continuity, response time, delay, usability, security, privacy and availability are defined for preparing quality of service information. The value of these attributes represent amount of quality of services [6, 7]. Normally, the goal of ranking of services is helping users to evaluate and compare various services. So, the users can select the most suitable and appropriate service that satisfies their requirement. This paper includes the various service rankings principle. Firs part treat evaluation and comparison of services and the second part treat service ranking. Service ranking and selecting most appropriate service is performed by some approaches. All of these approaches have their own compensation and boundaries. Mentioning their advantages and disadvantages or boundaries is useful for preparing an capable ranking system.

II. RANKING CIRCUMSTANCES

In this section, concepts of ranking, system monitoring and quality of services are defined with the service measurement index. It is designed and developed by CSMIC.[27] Quality attributes which are used in service provider comparison are introduced at the end of this section.

1. Ranking: Generally, ranking is sorting and assigning a degree to some choices. This concept is applied in some cases, such as ranking of universities and web services and another where [14]. But, applying it in rank assignment to cloud services is a new concept which draws some attentions in recent years.

In cloud computing environment, ranking differs from other systems because of existing infrastructure. This infrastructure is connecting different components by means of Internet and internet connections are unpredictable [15]. Therefore in cloud environment, maybe different level of quality of service received by different users but for same cloud service. So it is required that a ranking system receives user's requests with different requirement levels. Then, it finds some services which satisfy user requirements and ranks them for each user based on QOS.

A framework is needed to perform these tasks. This framework should have the ability of receiving information from users and selecting the best service based on their requirements by service monitoring. Also, it is needed to consider following items for ranking of selected services [16, 17].

- How the value of each attributes is determined?
- Which attributes should be selected for ranking?
- Which algorithm should be applied for ranking?
- How to present them to the user?
- How to get the received result?

The answers of above questions are essential for ranking process. Different approaches may perform 1 and 2 in the same way. But, the only difference is in their approach or algorithm of ranking.

2. Service Monitoring: Monitoring is an action that observes the status of system and gathers and represents required information from different parts of system. Monitoring systems and services for collecting information could be performed in two different places. First, service providers can perform monitoring for being aware of their service performance. Second, a person or a system exist that is not a provider of the mentioned service, but perform monitoring just for getting information about servicing of that system [18]. Monitoring approaches mostly uses from benchmark or other tools for gathers the information about quality of services. These benchmarks for cloud services will be describes in related work.

3 .Quality of Service: Quality of service represents functional attributes of the given service based on quantity or quality. It also represents the ability of a network or system for presenting better services [19]. Represented services in cloud computing environment have qualitative attributes such as accountability, agility, cost, performance, assurance, usability, security and privacy [20]. These attributes are applied for comparing different cloud services. Their definition is reviewed in the next subsection.

4. Qualitative Attributes In Service Comparison: Cloud Service Measurement Consortium (CSMIC) [21] has determined some attributes for measuring cloud computing services and adopted these attributes in the form of Service Measurement Index (SMI)[22]. These attributes are applied for comparing different cloud services and they are designed based on International Standard Organization (ISO). These attributes provide a standard model for measuring and comparing business services. In fact, this segmentation represents a common view of qualitative attributes. Generally, seven primary attributes exist for service comparison, each of which has series of sub attributes. These attributes are defined as follow [27].

5. Cost-effectiveness: Federated Clouds provide a larger amount of resources, which helps ti improve cost-effectiveness and quality. This include improvement for both the user and the provider such as, for a given cost, reducing the time to completion, increasing the system throughput or optimizing the resource utilization[22].

6. Under-utilized: The data center cannot be turned off; a cloud can decide to provide resources to other clouds when it realizes that its data center is under-utilized at given time.

Diverse geographical locations: Cloud service providers establish their data centers worldwide. Hence, there is a possibility of load sharing and performance improvement

7. Avoidance of vendor lock-in: By using multiple clouds and being able to freely transit workload among them, a cloud client can easily avoid vendor lock-in. In case a provider changes a policy or pricing that impact negatively its clients, client could easily migrate to some other provider.

8. Better SLA to customers: a cloud provider can provide better Service Level Agreements (SLA) to customers, as the result of competitive [23,26].

9. Guaranteed performance: Due to limited resources, that are available with a single cloud service provider, sudden increase in workload may lead to decline of performance [20]. Cloud federation is facing this disadvantage by renting resources from foreign cloud service providers, there by guaranteeing the agreed QoS.

10. Guaranteed availability: During unexpected disasters, the cloud system will be able to recover the services by federating with other cloud service providers in unaffected.

III. SERVICE MEASUREMENT INDEX (SMI)

SMI attributes are suggested by the Cloud Service Measurement Index Consortium (CSMIC) for measuring and comparing the level of cloud service and also is approved by International Standardization Organization (ISO). SMI framework selects the providers based on accountability, [29]agility, assurance of service, cost, performance, security and usability [16]. The definition of the attributes is discussed below.

1. Accountability: This term refers to measure the specific characteristics of the cloud provider. It helps to create trust of a customer on the provider. It deals the factors such as auditability, compliance, data ownership, provider ethicality, sustainability, etc.

2. Agility: It is define to measure as a rate of change metric, showing how quickly new capabilities are integrated into IT as needed by the business. When considering a Cloud service's agility, organizations want to understand whether the service is elastic, portable, adaptable, and flexible.

3. Cost: It is important to express cost in the characteristics which are relevant to a particular business organization.

4. Performance: It is related to functionality, service response time and accuracy. Organizations need to understand how their applications perform on the different clouds and whether these deployments meet their expectations.

5. Assurance: This characteristic indicates the Cloud service performing as expected or promised in the SLA. Every organization looks to expand their business[30] and provide better services to their customers. Therefore, reliability, resiliency and service stability are important factors in selecting Cloud services.

6. Security: It includes many attributes such as protecting confidentiality and privacy, data integrity and availability.

7. Usability: It refers the rapid adoption of cloud services, easier to use and learn it. The usability of a Cloud service can depend on multiple factors such as Accessibility, Installability, Learnability, and Operatibility.

IV. RANKING APPROACHES IN MULTIPLE SERVICE PROVIDER

The following figure. 1 represents the various questions required to be answered to allow efficient use of resources in cloud computing environment.

- Can a new request be accepted without impacting accepted requests?
- How to map various user requests with different QoS parameters to VMs?
- What available resource should the request be assigned to? Or should a new VM be initiated to support the new request?

Platform layer uses admission control to interpret and analyse the user's QoS parameters and decides whether to accept or reject the request based on the capability, availability and price of VMs.[27] Scheduling component is responsible for allocating resources based on admission control decision.

1) Maximizing the profit by minimizing the number of VMs.
2) Maximizing the profit by rescheduling.
3) Maximizing the profit by exploiting the penalty delay.

1. Maximizing the profit by minimizing the number of VMs: It consists of two parts like the Admission Control and Scheduling.

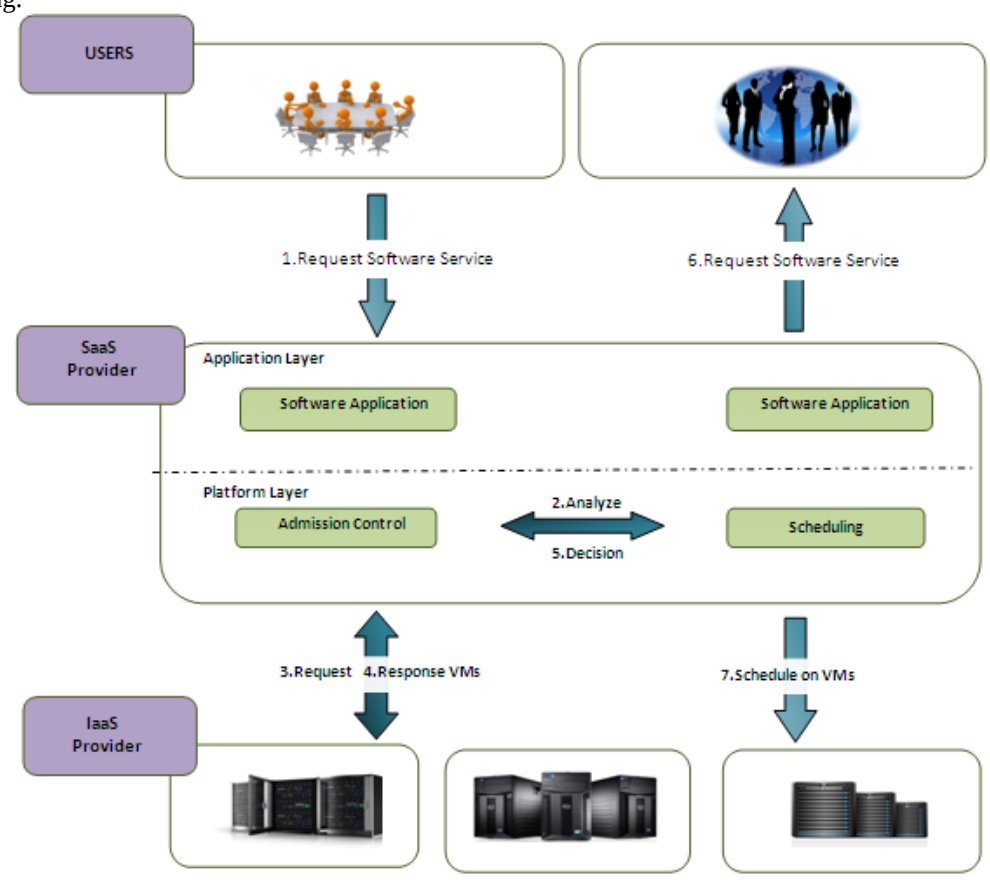

Figure 1. Ranking Architecture with SMI in multiple cloud service provider.

Admission Control: New request can be accepted either by queuing it up in an already initiated VM or by initiating a new VM. Checks if the new request can be queued up by [26]waiting for all accepted requests on any initiated VM – using wait strategy. If this request cannot wait in any initiated VM, then the algorithm checks if it can be accepted by initiating a new VM provided by any IaaS provider using Initiate New VM Strategy . If a SaaS provider does not make any profit by utilizing already initiated VMs nor by initiating a new VM to accept the request, then the algorithm rejects the request .Otherwise, the algorithm gets the maximum investment return.

Scheduling: Actual resource allocation and scheduling based on the admission control, algorithm *accepts* the new request, the algorithm first finds out in which IaaS provider and which VM a SaaS provider can gain the maximum investment return.

2. Maximizing the profit by rescheduling: A new user request does not get priority over any accepted request. This inflexibility affects the profit of a SaaS provider since many urgent and high budget requests will be rejected. Reschedule the accepted requests to accommodate an urgent and high budget request.

3. Maximizing the profit by exploiting the penalty delay: Delaying the new requests to accept more requests by using wait and insert strategies. Broker architecture is proposed for the deployment of virtual services across multiple clouds based on different scheduling algorithms, [30]different user constraint and environment conditions. Three Components: Cloud manager, which collects information from cloud providers; the Scheduler, which reads the user description file, invokes the selected scheduling strategy, and makes the placement decision; and the VM manager, which performs the deployment action.

4. Maximizing the profit by rescheduling: Rescheduling does not always provide profit. Alternative method suggests for improving the profit of SaaS using service differentiation for SLA members at application layer. **P**roposed work offers with rigid policy. Starvation caused due to service differentiation. [27]It is avoided by using tuning algorithm. Throughput involves both member and non-member request services. Hence, weight is assigned for each queue and dynamically change the weight by considering the previous status of the VM queue.

5. Maximizing the profit by exploiting the penalty delay: By comparing the existing strategies, allow the requests in the queue that consumes less resources using proposed scheduling called LCRF (Least Consuming Request First). Maximum consuming request may be allowed if it provides with higher priority SLA status compared to other requests in the queue. In turn balance the profit of SaaS.

6. Maximizing the profit by minimizing the number of VMs: Propose a new Load prediction algorithm for analysing the load of VMs and assign new requests to the appropriate VMs.

In our proposal, the total number of VMs offered by the IaaS is fixed. New VM may be created until the maximum allowed VMs signed with IaaS. [31]Cluster mechanism is used to distinguish the VMs. Based on the category of requests, cluster is formed, the incoming requests are assigned to the specific VMs with the help of admission control mechanism.

7. Deployment of virtual services on multiple cloud: Selection of Cloud based on dynamic pricing approach based on software engineering.

- Improves the scheduling module, which is responsible for optimizing a certain parameter of the service by providing an optimal deployment.
- In-house hosting can generate administration and maintenance cost while renting resources from a single IaaS provider can impact the service quality offered to SaaS customers due to the variable performance.
- To overcome the above limitations, multiple IaaS providers and admission control are considered that brings huge amount of resources, various price schemas,[32] and flexible resource performance to satisfy the SLA. Admission control is defined as a validation process in communication systems mechanisms to avoid overloading of resources and SLA satisfaction.

V. CONCLUSION

Ranking of services as a support evaluates different services and determines their right of way. In cloud computing environment, there are different cloud providers which present services with different qualitative characteristics such as efficiency and cost. By increasing number of service providers, choosing the best cloud computing service for a specific application is a serious challenge for users. Ranking prioritizes services for selecting the most appropriate service. To conclude that the standards of the ranking system should be considered at first for having an efficient status system. So, a system has capability to react at any condition. Also, it is essential to compute all of the qualitative values of preferred services exactly. In this context, this work does a review on the various approaches for ranking cloud computing services and analyzes them. Some of the user's challenges about selecting best service that satisfies user requirements.

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