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# RANKING THE CLOUD SERVICES BASED ON QOS PARAMETERS

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***Abstract*: Cloud computing has become an important paradigm for outsourcing various IT needs of organizations, by enabling them to offer access to their infrastructure and application services on a subscription basis, there are many Cloud providers offer different Cloud services with different price and performance attributes. It has also becomes challenging for Cloud customers to find the best Cloud services which can satisfy their QoS requirements in terms of parameters such as performance and security. In this project work, we propose a structural design and a mechanism for measure the quality and prioritize Cloud services. The aim of this framework is to define each of the QoS attributes given in the framework and provide a methodology for computing a relative index for comparing different Cloud services and will create healthy competition among Cloud providers to satisfy their Service Level Agreement (SLA) and improve their QoS. Analytical Hierarchical Process (AHP) based Prioritize mechanism to solve the problem of assigning weights to features considering the interdependence among them, thus providing a much required quantitative basis for the Prioritize of Cloud services.**
***Keywords:* Automated negotiation, Cloud negotiation, Cloud resource allocation, multi-issue negotiation, negotiation agent, resource management.**

## I. INTRODUCTION

Cloud computing has emerged as a paradigm to deliver on demand resources (e.g., infrastructure, platform, software, etc.) to customers parallel to extra utilities (e.g., water, electricity and gas). The three prevailing classes of cloud computing are Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS). SaaS describes systems in which high-level functionality (e.g., SalesForce.com, which provides customer relationship management software as an on-demand service) is hosted by the cloud and exported to thin clients through the network. The most important feature of SaaS systems is that the API offered to the cloud client is for a complete software service and not programming abstractions or resources. Commercial SaaS systems typically charge according to the number of users and application features.

The traditional computing model that uses dedicated, in-house infrastructure, cloud computing offers unprecedented advantages in terms of cost and reliability. A cloud customer need not pay a large upfront cost (e.g., for hardware purchase) before launching services, or over-provision to accommodate future or peak demand. Instead, the cloud's pay-as-you-go charging model enables the customer to pay for what she actually uses and promises to scale with demand. Moreover, the customer can avoid the cost of maintaining an IT staff to manage her server and network infrastructure. Cloud computing offers significant benefits to these businesses and communities by freeing them from the low-level task of setting up IT infrastructure and thus enabling more focus on innovation and creating business value for their services.

Due to such business benefits offered by Cloud computing, many organizations have started building applications on the Cloud infrastructure and making their businesses agile by using flexible and elastic Cloud services. But moving applications and/or data into the Cloud is not straightforward. Numerous challenges exist to leverage the full potential that Cloud computing assures. These challenges are often associated to the fact that existing applications have specific requirements and characteristics that need to be met by Cloud providers.

In this context, the Cloud Service Measurement Index Consortium (CSMIC) [5] has identified metrics that are combined in the form of the Service Measurement Index (SMI), offering comparative evaluation of Cloud services. These measurement indices can be used by customers to compare different Cloud services. In this paper, based on these identified characteristics of Cloud services, we are taking the state of the art one step further by proposing a framework (SMICloud) that can compare different Cloud providers based on user requirements. The SMICloud would let users match up to dissimilar Cloud offerings, along with their priorities and along more than a few dimensions, and choose whatever is suitable to their needs.

Several challenges are tackled in realizing a model for evaluating QoS and ranking Cloud providers. The initial is how to determine various SMI attributes of a Cloud service. Many of these attributes vary over time. For example, Virtual Machine (VM) performance has been found to vastly vary from the promised values in the Service Level Agreement (SLA) by Amazon [4]. However, without having precise measurement models for each aspect, it is not possible to match up to different Cloud services or even determine them. Therefore, SMICloud uses historical dimensions and merges them with guaranteed values to find out the actual value of an aspect. We also give exact metrics for each computable attribute.

## II. SERVICE MEASUREMENT INDEX (SMI)

SMI attributes are designed based on the International Organization for Standardization (ISO) standards by the CSMIC consortium. It consists of a set of business-relevant Key Performance Indicators (KPIs) that provide a standardized method for measuring and comparing business services. The SMI framework provides a holistic view of QoS needed by the customers for selecting a Cloud service provider based on: Accountability, Performance, Agility, Assurance of Service, Privacy, Cost, Security and Usability. There are currently no publicly available metrics or methods which define these KPIs and compare Cloud providers. SMI is the first effort in this direction. The following defines these high level attributes:

- **Accountability:** This group of QoS attributes is used to measure various Cloud provider specific characteristics. This is essential to make the trust of a customer on any Cloud provider. No association will want to set up its applications and store their critical data in a place where there is no accountability of security exposures and compliance. Functions serious to responsibility, which SMI considers when computing and score services, include auditability, sustainability, compliance, data ownership, provider ethicality, etc.
- **Agility**: The most important advantage of Cloud computing is that it adds to the agility of an association. The association can enlarge and modify rapidly without much expenses. Agility in SMI is calculated as a rate of modify metric, showing how rapidly new capabilities are included into IT as needed by the corporation. When allowing for a Cloud service's agility, associations want to recognize whether the service is expandable, convenient, adaptable, and flexible.
- **Cost**: The first question that arises in the mind of organizations before switching to Cloud computing is whether it is cost efficient or not. Therefore, cost is obviously one of the very important aspects for IT and the business. Cost tends to be the exacting most quantifiable metric nowadays, but it is essential to communicate cost in the characteristics which are appropriate to a exacting business association.
- **Performance:** There are many different solutions offered by Cloud providers addressing the IT needs of different associations. Each result has different performance in terms of functionality, service response time and accuracy. Associations need to realize how their applications will perform on the different Clouds and whether these deployments meet their expectations.
- **Assurance**: This characteristic indicates the likelihood of a Cloud service performing as expected or assured in the SLA. Each association looks to enlarge their production and offer better services to their clients. Therefore, consistency, resiliency and service strength are important factors in selecting Cloud services.
- **Security and Privacy**: Data protection and privacy are important concerns for nearly every organization. Hosting data under another organization's control is always a critical issue which requires stringent security policies employed by Cloud providers. For example, economic associations usually require compliance with regulations involving data integrity and privacy. Security and Privacy is multi-dimensional in nature and includes many attributes such as protecting privacy and confidentiality, data reliability and availability.
- **Usability**: For the rapid adoption of Cloud services, the usability plays a vital role. The easier to use and learn a Cloud service is, the more rapidly an association can switch to it. The usability of a Cloud service can depend on multiple factors such as convenience, Installability, Learnability, and Operatibility.

## III. SMI CLOUD ARCHITECTURE

We propose the Service Measurement Index Cloud framework—SMICloud—which helps Cloud customers to find the most suitable Cloud provider and therefore can initiate SLAs. The SMICloud framework provides features such as service selection based on QoS requirements and ranking of services based on previous user experiences and performance of services. It is an assessment manufacturing tool, designed to provide assessment of Cloud services in terms of KPIs and user requirements. Customers provide two categories of application requirements: essential and non-essential.

Essential requirements allow the customer to specify 'deal-breakers', i.e. if a certain SMI attribute does not meet the required level, then the service is improper, apart from of how all the other aspects are scored. The essential and non-essential requirements depend both on customers and their application needs. For example, for an academic user, the security level may not be an 'essential' requirement if their project is of no commercial significance.

  

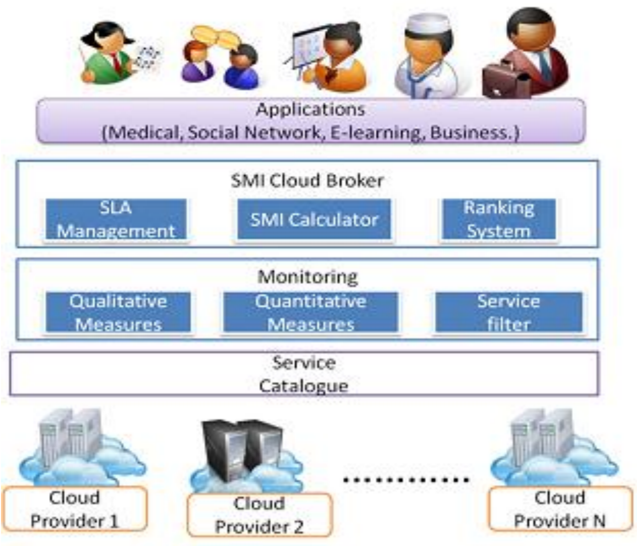


**Fig. 1.** SMICloud framework.

**1. SMICloud Broker:** This component is responsible for interaction with customers and understanding their application needs. It collects all their requirements and performs discovery and ranking of suitable services using other components such as the SMICalculator and Ranking systems. SLA Management is the component that keeps track of customers' SLAs with Cloud providers and their fulfillment history. The Ranking System ranks the services selected by the Cloud Broker which are appropriate for user needs. The SMI Calculator computes the various KPIs which are used by the ranking system for prioritizing Cloud services.

**2. Monitoring:** This component first discovers Cloud services that can satisfy users' essential QoS requirements. Then, it monitors the performance of the Cloud services, for example for IaaS it monitors the speed of VMs, memory, scaling latency, storage performance, system latency and accessible bandwidth. It also maintains way of how SLA requirements of previous clients are being satisfied by the Cloud provider. For this level, various tools are accessible, some of which we discuss about in the associated work segment.

**3. Service Catalogue:** Stores the services and their features advertised by various Cloud providers. The details about services that are asked by the users, which are provided to them as a response to the request given by the users are also stored in the service catalogue.

## IV. IAAS PROVIDER QUALITY MODEL

Cloud computing services can be estimated based on qualitative and quantitative Key Performance Indicators (KPIs). Qualitative are those KPIs which cannot be quantified and are mostly inferred based on user experiences. Quantitative are those which can be calculated using software and hardware monitoring tools. For example, providers' ethicality and security attributes are qualitative in nature. Since these KPIs represent generic Cloud services, only several of them are essential for particular applications and Cloud services. For instance, the install ability aspect in usability is more important to IaaS providers than SaaS providers since in SaaS there is almost no installation on the client end. Additionally, the same KPI can have different descriptions based on the service. A few of these parameters depend on client applications and a few are independent. For instance, suitability is dependent on the client while elasticity is determined by the provider.

Therefore, it is complex to define precisely the SMI values for a provider, particularly when there are various parameters involved and parameter definitions also depend on many sub-aspects. Here we give some instance descriptions for the most important quantifiable KPIs, mostly in the perspective of IaaS. However, most of these proposed metrics are valid for other types of services. The modeling of qualitative attributes is beyond the scope of this paper.

## V. PROPOSED SCHEME

### The Optimized path scheduling algorithm

The Optimized path scheduling algorithm receives a path as input and tries to find a schedule for its tasks that minimizes the total cost of the path and finishes each task before its latest terminates time. We propose special policies for scheduling a path as follows. We try to find the economical schedule that can finish the tasks of the path before their latest finish time.

```
procedure SchedulePath(path)
    for all tasks t_k ∈ path do
        for d = EST(t_1) to EFT(t_k) − 1 do
            C[k, d] = ∞
        end for
        for t = EFT(t_k) to LFT(t_k) do
            if (t_k is the first task on the path) then
                compute c[1, t] according to Eq. (5)
            else
                compute c[k, t] according to Eq. (6)
            end if
        end for
        for t = LFT(t_k) + 1 to LFT(t_l) do
            c[k, t] = ∞
        end for
    end for
    find the optimal schedule based on c[l, LFT(l)]
    set EST, LFT and SS based on the optimal schedule
    mark all tasks of the path as scheduled
end procedure
```

Fig 2: Optimized path scheduling algorithm

Since the problem of finding the optimal schedule for an ordered list of tasks, or, more exactly, a linear workflow is also an NP-complete problem, there is no polynomial instance algorithm to resolve it. Fortunately, this problem can be formulated as an extension of a classic problem, identified as the various option Knapsack Problem (MCKP).

  

```
procedure SchedulePath(path)
    repeat
        for all (t_i ∈ Path) do
            if (scheduling t_i on the next service is feasible) then
                SS(t_i) ← next slower service
                update the EST and the LFT of other tasks on the path
            end if
        end for
    until (no change is done)
    set EST, LFT and SS according to best for all tasks ∈ path
    mark all tasks of the path as scheduled
end procedure
```

Fig 3: Fair Path Scheduling Algorithm.

This algorithm can efficiently solve the MCKP in various cases. However, the most efficient accurate algorithm for the MCKP is based on the Branch and Bound approach [15]. These algorithms usually find the optimal solution for a relaxed version of the problem, e.g. linear programming recreation, which lets 0 6 xij 6 1, and use it as an upper bound for the original problem. With this upper bound, they reduce incomplete solutions whose upper bound is less than the current greatest solution. At last, there are a few polynomial time approximation algorithms which try to find an inexact (approximate) solution with a bounded worst-case relative error, denoted by ϵ. It means P – P ∗6 ϵ P∗, where P ∗ is the optimal solution for the problem, and P is the solution found by the approximation algorithm.

**Performance evaluation**

In this section, we will present our simulations of the Cloud Partial Critical Paths algorithm Quality of Service (QoS) [12] plays a critical role in the affective reservation of resources within service oriented distributed systems. The Cloud Computing is promoted by the business rather than academic which determines its focus on user purposes. Different users contain different QoS constraints. So along with the particular target and resources, the proposal is formulated on scheduling model from the user's perspective. The first is how to measure various QOS attributes of a Cloud service. Many of these attributes vary over time. However, without having precise measurement models for each aspect, it is not possible to evaluate different Cloud services or even discover them. The attributes are Accountability, Agility, Assurance of Service, Security and Privacy, and Usability.

**Accountability**

This group of QoS attributes is used to measure various Cloud provider specific characteristics. This is important to build the trust of a customer on any Cloud provider. No association will desire to deploy its applications and store their critical data in a place where there is no accountability of security exposures and compliance.

**Service response time**

The efficiency of service availability can be measured in terms of the response time, i.e. in the container of IaaS, how rapid the service can be made accessible for usage. For example, if a user requests a virtual machine from a Cloud provider, then the service response time will represent the time taken by the Cloud provider to serve this demand. This contains provisioning the VM, booting the VM, allocating an IP address and starting application deployment. The service response time depends on various sub-factors such as average response time, maximum response time promised by the service provider, and the take of time this response time stage is missed.

**Reliability**

Reliability reflects how a service operates without failure during a given time and situation. Therefore, it is identified based on the mean time to collapse assured by the Cloud provider and previous failures experienced by the users. Reliability of storage can be defined in terms of durability that is the chance of failure of a storage device.

**Stability**

Stability is defined as the variability in the performance of a service. For storage, it is the variances in the average read and write time.

**Performance**

There are many different solutions offered by Cloud providers addressing the IT needs of different associations. Every result has different performance in terms of functionality, service response time and accuracy. Associations require understanding how their purposes will perform on the different Clouds and whether these deployments meet their expectations.

**Assurance**

This characteristic indicates the likelihood of a Cloud service performing as expected or promised in the SLA. Each association seems to enlarge their production and provide better services to their clients. Therefore, consistency, resiliency and service strength are important factors in selecting Cloud services.

**Security and Privacy**

Data protection and privacy are important concerns for nearly every organization. Hosting data under another organization’s control is always a critical issue which requires stringent security policies employed by Cloud providers. For example, financial associations usually require compliance with regulations involving data integrity and privacy. Security and Privacy is multi-dimensional in nature and includes many attributes such as protecting privacy and confidentiality, data reliability and accessibility.

**Cost**

The first question that arises in the mind of organizations before switching to Cloud computing is whether it is cost efficient or not. Thus, cost is obviously one of the essential aspects for IT and the business. Cost tends to be particular mainly quantifiable metric today, other than it is essential to communicate cost in the characteristics which are relevant to a particular business organization.

## VI. CONCLUSION

Cloud computing has become an important paradigm for outsourcing various IT needs of organizations. Currently, there are many Cloud providers who offer different Cloud services with different price and performance attributes. With the growing number of Cloud offerings, even though it opens the chance to leverage the virtually infinite computing resources of the Cloud, it has also becomes challenging for Cloud customers to find the best Cloud services which can satisfy their QoS requirements in terms of parameters such as performance and security. To choose appropriately between different Cloud services, customers need to have a way to identify and measure key performance criteria that are important to their applications. Therefore, the Cloud Service Measurement Index Consortium (CSMIC) proposed a framework based on common characteristics of Cloud services. The plan of this association is to describe each of the QoS attributes given in the framework and provide a methodology for computing a relative index for comparing different Cloud services.

## REFERENCES

[1] R. Buyya, C. Yeo, S. Venugopal, J. Broberg, I. Brandic, Cloud computing and emerging IT platforms: vision, hype, and reality for delivering computing as the 5th utility, Future Generation Computer Systems 25 (6) (2009) 599–616.
[2] M. Cusumano, Cloud computing and SaaS as new computing platforms, Communications of the ACM 53 (4) (2010) 27–29.
[3] E. Ciurana, Developing with Google App Engine, Apress, Berkeley, CA, USA, 2009.
[4] J. Varia, Best practices in architecting cloud applications in the AWS cloud, in: Cloud Computing: Principles and Paradigms, Wiley Press, 2011, pp. 459–490. (Chapter 18).
[5] Cloud Service Measurement Index Consortium (CSMIC), SMI framework. URL:http://beta-www.cloudcommons.com/servicemeasurementindex.
[6] J. Cochrane, M. Zeleny, Multiple Criteria Decision Making, Univ. of South Carolina Pr., 1973.
[7] H. Pan, Green Data Centers monthly newsletter February 2010, Information Gatekeepers Inc.
[8] Rackspace, Cloud servers, URL: http://www.rackspace.com.
[9] IEEE Standards Association and Others, IEEE STD 1061-1998, IEEE standard for a software quality metrics methodology, 1998.
[10] W. Sobel, S. Subramanyam, A. Sucharitakul, J. Nguyen, H. Wong, S. Patil, A.Fox, D. Patterson, Cloudstone: multi-platform, multi-language benchmark and measurement tools for web 2.0, in: Proceedings of Cloud Computing and its Application, Chicago, USA, 2008.
[11] C. Harmony, Cloudharmony.com, February 2012., http://cloudharmony.com/.
[12] A. Li, X. Yang, S. Kandula, M. Zhang, CloudCmp: comparing public cloud providers, in: Proceedings of the 10th Annual Conference on Internet Measurement, Melbourne, Australia, 2010.
[13] M. Zeleny, Multiple Criteria Decision Making, vol. 25, McGraw-Hill, New York,
1982.
[14] J. Dyer, Mautmultiattribute utility theory, Multiple Criteria Decision Analysis: State of the Art Surveys, 2005, pp. 265–292.
[15] J. Figueira, S. Greco, M. Ehrgott, Multiple Criteria Decision Analysis: State of the Art Surveys, vol. 78, Springer Verlag, 2005.

  