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Investigation of Quality Model for Cloud Services

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Abstract: In world of internet of things (IoT), cloud computing is an essential aspect.In this world of technological data, cloud computing is the trendy buzzword. It is a procedurein which weare storing data. With varying quality specifications cloud have to aid significantquantity of interactions. An major differentiator between the cloud providers isservice quality. Cloud vendors ought to provide sophisticated services that meet theircostumers' requirements. To measure, characterize and compare quality of theproviders, a satisfactory model can be used so that a trust can be situated amongstcloud stockholders. In this paper, we take a service viewpoint to initiate aqulality model which is named as CLOUDQUAL and used for cloud services. Thisis a model containing six first-class dimensions that goals basic cloud services.The six quality dimensions are security, usability, elasticity, availability, responsiveness and reliability where in usability is subjective and ultimate fiveare objective. To illustrate result of CLOUDQUAL, we conduct case learn oftwo storage clouds. Results exhibit that CLOUDQUAL can evaluate anddifferentiate cloud's quality.

Keywords-Cloud computing, Validity criteria, Internet of Things (IoT), Cloudquality model.

I. INTRODUCTION

Cloud computing has grown in popularity in contemporary yearsdue to technical and affordable benefits of the ondemand ability controlmodel [1]. Many cloudoperators are actually lively available on the market, providing awealthy offering, together with Infrastructure-as-a-service (IaaS),Platform-as-a-service(PaaS), and software-as-a-service(SaaS) solutions [2]. The cloud technology stack has alsoturn out to be mainstream in manufacturer data centers, whereconfidential and hybrid cloud architectures are increasinglyadopted.Although the cloud has widely simplified the ability provisioning method, it poses a number of novel challengesin the field of quality-of-service (QoS) management. QoSdenotes the phases of efficiency, reliability, and availability furnished via an application and by way of the platform orinfrastructure that hosts ita. QoS is important for cloudclients, who expect vendors to give the advertised high-quality characteristics, and for cloud vendors, who have got tofind the right tradeoffs between QoS phases and operational expenses. Nevertheless, discovering finest tradeoff is a elaborate determination drawback, normally exacerbated by the presenceof service level agreements (SLAs) specifying QoS goalsand reasonably priced penalties related to SLA violations [3].

In Information Technology, Internet of Things has emerged as the next revolutionary technology.Internet of Things allows objects like sensors, computers, mobile phones etc. to communicate viaInternet. It has ability to transfer the current static Internet into full integrated future Internet.With varying quality requirements cloud computing supports large number of interactions.Therefore service quality will be important differentiator among the cloud providers. IT giantsfrom Google to Amazon to Microsoft to IBM have entered cloud market to expand their businessand to acquire new customers. Cloud services means XaaS services (XaaS) where X can besoftware, hardware and application. Cloud providers need to provide superior services so as tofulfill customer's requirements. Cloud services are delivered in Internet based environment, withno more human interaction or little bit. Resulting, how to measure and define their qualitybecomes a new problem [4]. It helps to create knowledge of service quality, i.e. how to measureit and what it means, such that a quality dimension like availability is

mentioned, it meansexactly same things to two parties and the same metric is given to measure [1,4].

II. RELATED WORKS

The work has been done by many researchers towards SaaSevaluation is comparatively very less till the year 2005,afterward, work have been contributed towards SaaSevaluation. Till today, many quality models were introducedto evaluate various services on the cloud in general. But thereare only very few quality models were proposed for SaaS. Inthis paper around 20 research papers were studied thoroughlyand analyzed properly based on basic quality attributes.

In the year 2008, the author Si Won Choi and Soo Dong Kimwork [1] proposes the broad quality model for evaluatingreusability of services published over Service OrientedArchitecture. Mainly they targeted reusability as a key factorto evaluate the quality of any service either Atomic orcomposite. But traditional frameworks have not successfullyhelped SaaS-specific quality aspects such as reusability andaccessibility.

In the year 2009 the work towards SaaS usage have beenincreased, thus led to implementing some quality models toevaluate the quality of SaaS on the cloud computingenvironment. Manish Godse and ShrikantMulik researchwork [3] presented an approach that has used AnalyticHierarchy Process (AHP) procedure intended for the rankingthe product features. So that users of SaaS, can provideranking to each product. Author's work suggested the use ofAHP as quantitative techniques for selection of some

particular parameters of a product like Architecture, VendorReputation, Cost, Functionality and Usability. Jae Yoo Lee,Jung Woo Lee, Du Wan Chen and Soo Dong Kim's researchwork [2] demonstrated a complete model for evaluatingquality of SaaS thus key features of SaaS have been identifiedas Reusability, Data Managed by Providers, Customizability,Availability, Scalability, and Pay per Use. And then derivedquality attributes from the key features and defined metrics toevaluate the quality attributes.

Yonghe Lu and Bing Sun together analyzed and proposedresearch work [4] based on identifying constraints of SaaS.Their work with the emphasis more on system performanceand security requirement along with industry standardization,business complexity. Their model evaluates enterpriseinformation systems from three aspects: enterprise resource,system features, and SaaS service fitness. From the year 2010to 2012, the research work towards evaluation of cloudservices had been increased vastly, but not specificallytowards SaaS evaluation. Qian Tao, Huiyou Chang, YangYi1, Chunqin GU presented research work [5] considereddifferent cloud services QoS parameters including time, cost,reliability, availability, reputation and security. Then atrustworthy QoS data computing model is established andtrustworthy of any cloud service had been tested by applyingPAM clustering. This work is more focused on generalservices on the cloud which may not meet the specificrequirement of trust worth of SaaS, because it is differentfrom other services.

Chen Yiming and Zhu Yiwei work [6]presents that Analytic hierarchy process is used to hand pickthe best SaaS vendor for enterprises. By means of creating thehierarchy model, analyzing the attributes and calculating theattribute values. With the purpose of this particular method issuitable to select the SaaS vendor but not SaaS product. JerryGao, PushkalaPattabhiraman, XiaoyingBai w. T. Tsaipresented their research work [7] as a new formal graphicmodels and metrics to evaluate SaaS performance andscalability features. The results have shown best potentialapplication and effectiveness of the proposed model forevaluating SaaS scalability and performance attributes only.But not on other attributes, which are also playing animportant role for good quality. Zia urRehman proposedwork [8] discussed and proposed a multi-criteria cloud serviceselection methodology in general. Very important parameterslike reliability, trust, reputation, etc. are not given importanceeven though they are very critical in the cloud computingenvironment.

Qiang He, Jun Han, etc. proposed work [9] isused to evaluate the attribute multi-tenancy cloud-basedsoftware applications with less scalability. It may not suitableif the number of end users are increasing. Tung-Hsiang Chouand Wanting Liu research work [10] presented that some ofthe SaaS dimensions, integrated along with servicedimensions of SERVQUAL to maintain the standard ofcustomer service. So that presented work is only benefitedwith very few attributes of SaaS, not applied to qualityparameters.

Pang Xiong Wen and Li Dong proposed work [11] that anovel quality model to evaluate the security, quality ofservice, and software quality of the SaaS service, from theperspective of the service provider and service customersindependently. NiyatiBaliyan and Sandeep Kumar [12]presented their work in such a way that typical quality factorshave been identified and used fuzzy logic to assess SaaSquality. Lukas Burkon work [13] presented the variancesbetween traditional IT outsourcing and SaaS by introducingthe set of quality attributes suitable to SaaS management.

RaedKarim, Chen Ding presented their work [14] The AHPbased model to facilitate the mapping procedure through fewcloud layers and provided the priority to cloud services forend users perspective. Ankit Banka and AnshulSaravg etc.proposed their research work towards SaaS evaluation [15]based on the security attribute, which is used as adistinguished factor for selection of SaaS services. In general,there are many parameters involved and influencing in SaaSservice quality than security like availability, reliability, etc.Jun Guo, Hao Huang, Xiaofeng Shi, Fang Liu, Bin Zhangwork [16] presented only about SaaS performance. The SaaSperformance prediction is influenced by SaaS resourceoccupancy, plus SaaS transactions.

In the year 2014, the authors TriptKaur etc. work [17]demonstrated more about the cost attribute of the SaaS servicerather than other attributes. Amid Khatami Bardsiri work [18]presented that set of service metrics to evaluate the quality ofcloud services in general rather than the quality of the SaaSservice. Sarbojit etc. presented in their research work [19] byintroducing a new quality model for the security, quality ofservice, and software quality for software as a service ingeneral theatrically rather than specific towards overallquality of SaaS. XianrongZheng [20] presented his workCLOUDQUAL inspired by SERVQUAL, with six qualitydimensions like usability, availability, reliability,responsiveness, security, and elasticity, of which usability isindependent and the others are objective

III. THE PROPOSED APPROACH

CLOUDQUAL is a quality model that we propose for cloud services. As to its six qualitydimensions, five are objective and negotiable, whereas usability remains subjective and nonnegotiable. While some quality dimensions of CLOUDQUAL like availability and reliability areused in other papers, we take a new perspective on them in this paper. Instead of a systemperspective assumed in most papers, we regard them from a service perspective, i.e., an enduser's viewpoint, and re-define accordingly the quality dimensions and metrics. So, even if theyare not brand new, they are from a new angle.

A. Goals and Objectives:

a. To develop a cloud quality model.
b. To compare the quality of cloud using six quality dimensions.
c. Validate the cloud services on the basis of standard validation criteria.
d. To provide cloud of best quality.
e. To notify users about quality of different clouds.

B. Mathematical Modeling

Let 'B' be the | Cloud Quality system at the final set
B= {I, O, F, $}
Identify the Functions/Modules as,
F= {U, A, Rel, Resp,S, E}
U=Usability
A=Availability
Rel=Reliability
Resp=Responsiveness
S=Security
E=Elasticity.
Identify the Inputs as,I= {c,co,d }

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Where,
c=Correlation
co=Consistency
d=Discriminative power
Identify the outputs as,
O= {uv,av,rv,resv,sv,ev }
Where,uv=Usabilityval
av=Availabilityval
rv=Reliabilityval
resv =Responsivenessval
sv=Securityval
ev=Elasticityval
Identify the Constraints as,$= 1.if cloud is secured with firewall then it is difficult to retrieve these parameters to determineits quality.

1st Module: Usability Module

U= {g,f }
g=gui,
f=features

2nd Module: Availability Module

A= {t,ts,av}
t=Uptime of operational period,
ts=Total time of operational period.
av=Availabiityval.
Formula,av=t/ts

3rd Module: Reliability Module

Rel={n,ns,rv}
Where,
n=No. of failed operations,
ns=Total operations occurred in a time interval.
rv=Realiabilityval
Formula,
rv=1-n/ns

4th Module: Responsiveness Module

Resp={fi,ti,tmax,resv}
Where,
fi=Measure central tendency offset of data,
ti=Time between submission and completion,
tmax=Max acceptable time to complete request.
resv=responsivenessval
formula,resv=1-fin=1(ti)/tmax

5th Module: Security Module

S={FT(t),sv}
Where,FT(t)=Cumulative distribution function of random variable T,
t=Time until first security breach occurs.
sv=securityval
Formula,
sv=1-FT(t)

6th Module: Elasticity Module

E={ri1,ri2,n,ev}
Where,
ri1=Amount of resources allocated,
ri2=Amount of resources requested,
n=No. of required resources in operation period.
ev=elasticityval
formula,ev=∑ni1=1ri1/∑ni2=1ri2
4th Identify the functions as 'F'
F={Usability(),Availability(),Reliability(),Responsiveness(),
Security (),Elasticity()}
Usability (h) =P' :: takes the gui.
P' = { h | h takes the gui }

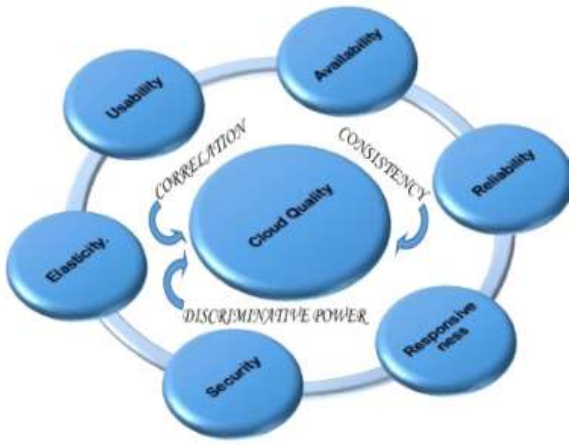

Fig: Architecture of Quality Model

Availability (d) =A' :: takes the uptime and total time of operational period.A' = { d | d takes the uptime and total time of operational period }

Reliability (c) =B' :: takes No. of failed operations and Total operations occurred in a timeinterval.B' = { c | c takes No. of failed operations and Total operations occurred in a time interval.}

Responsiveness (m) =D' :: takes Time between submission and completion.D' = { m | m takes Time between submission and completion }

Security (f)=G:: takes Cumulative distribution function of random variable T and Time untilfirst security breach occurs.G={f|f takes Cumulative distribution function of random variable T and Time until first securitybreach occurs.}

Elasticity (n)= E::takes Amount of resources allocated and Amount of resources requestedE={n|n takes Amount of resources allocated and Amount of resources requested.}

IV. CONCLUSION

Cloud computing is an fundamental component of the spine of the IoT. Clouds will be requiredto support significant numbers of interactionswith various fine requirements.Provider excellent will as a result be anmost important differentiator amongst cloudproviders. Because the spectrum of cloudservices expands, how to define andmeasure their high-quality becomes anmain situation. In this paper,encouraged from SERVQUAL and the eservice exceptional model, we take a serviceviewpoint, and provoke a first-class modelfor cloud services. It is a model thattargets basic cloud assistances. Quality model includes six quality dimensions,i.e., usability, availability, reliability,responsiveness, protection, and elasticity.A proper specification is given for everyexcellent dimension, and a exceptional metricis outlined for each and every goal one.

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