

## SERVICE LEVEL AGREEMENT FRAMEWORK FOR E-COMMERCE CLOUD END-USER PERSPECTIVE

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**Abstract**—Cloud computing provides a large pool of accessible resources (hardware, platform, software) in a form of services. It became a cost effective alternative to the traditional IT infrastructure. Nowadays, as more and more e-commerce companies delegate their task to cloud providers, Services Level Agreement (SLA) became an important aspect between the cloud consumer and cloud provider, the dynamic nature of cloud computing needs to continue monitoring of the services. The restricted choice of appropriate parameters in SLA affects the interacting of end user with cloud services and creates risks of user data. End users are concerned about their data and how it will be stored in cloud and how the data is recovered in the case of failure of disaster. However, none of SLAs consider the end user view while conducting the SLA document. In this paper, we reviewed the existing SLA framework in cloud computing and introduced SLA framework for e-commerce cloud based on WSLA lifecycle. In this paper, a list most appropriate parameters and objectives which should be included in the SLA are provided to alleviate the risks facing the e-commerce cloud end user. The proposed framework may provide holistic guarantee for the end user to interact with e-commerce cloud websites.

**Keywords**- Cloud Computing; E-commerce cloud; Services Level Agreement

### I. INTRODUCTION

Cloud computing is a general term to describe the process of delivering hosted services over the internet. According to NIST (National Institute Of Standards and Technology) definition : "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"[1]. Cloud services are generally categorized into three parts: Software-as-service, Infrastructure-as-service (IaaS) and Platform-as-service (PaaS)[2]. Of late, many ecommerce companies move to cloud services. According to Gartner group report, in 2013, 40 % of e-commerce companies will use a complete cloud services (SaaS) solution, which is going to change the way how businesses operate[3]. From the business perspective,

cloud computing can facilitate e-commerce companies by reducing the cost of IT infrastructure, operation and maintenance[4].

However there are some risks facing the end user during interaction with ecommerce cloud websites [5]. End users are concerned about the confidentiality of their data and how it stored in the cloud.[6] pointed out that "the capabilities of cloud computing to scale rapidly , store user data remotely , and share services in a dynamic environment can thus become disadvantages in maintaining the level of privacy assurance sufficient to sustain confidence in potential users".

This paper is organized as follows. Section I discusses challenges and risks facing end user when interacting with ecommerce cloud. Section II presents the literature review of the exiting SLA frameworks. Cloud SLA and the main parameters, objectives in cloud SLA discussed in Section III. Section IV explains the proposed Ecommerce cloud SLA framework based on the literature. Finally, the conclusion and further study are summarized in Section VI.

### II. RISKS AND CHALLENGES FACING END-USER IN E-COMMERCE CLOUD

Cloud computing helps companies to quickly build up an e-commerce website by on demand purchase and use. This can totally reduce the cost of building e-commerce website and maintenance costs. In addition, cloud service providers offer professional teams to help in e-business application and hardware maintenance. This can allow the e-commerce seller to focus on the core business process .In ecommerce cloud sellers, a large number of users information is stored in the cloud and transmission and processing taking place in cloud, therefore, the problems and risks more than traditional e-commerce model.[2]

Increasingly, online retailers are relying on cloud services and applications such as storage, computing, comparison engines, product locators and dynamic imaging to run their businesses. Outsourcing services may pose high risks to the retailers. As a result, they are losing control of the end user experience. The main risks discussed below.

### A. Data confidentiality and privacy

In cloud computing, most of the business information are stored in the cloud, e-commerce companies will be unable to supervise and monitor user's business sensitive information. As virtualization technology been used in cloud computing, e-commerce companies using cloud services are not clear about where the data been stored, and do not even know in which country the data is located.[2]. Privacy issues are very crucial in Cloud Computing. The dynamic nature and structure of Cloud environment make it difficult for Cloud providers to follow the current data privacy and protection rules. The main reason for this is due to the transnational nature of Cloud Computing that has to face the national nature regulation privacy[7]. The current cloud service contracts are not taking sufficient attention on consumer privacy. Indeed, to the extent that consumers are poorly informed about privacy issues[8]. The European Network and Information Security Agency(ENISA), conducted a survey for the main cloud computing security issues. More than 70 % of the SME (small and medium enterprises) in this study are concerned by the first six criteria and more specifically by confidentiality of data.

Table 1: Main Security Issues Facing the Organizations by (ENISA)

Criteria	Very Important	Showstopper	Total
Confidentiality of corporate data	30,9%	63,6%	94,5%
Privacy	43,9%	43,9%	87,8%
Availability of services and/or data	47,3%	40,0%	87,3%
Integrity of services and/or data	42,6%	44,4%	87,0%
Loss control of services and/or data	47,2%	28,3%	75,5%
Lack of liability of providers in case of security incidents	43,1%	29,4%	72,5%
Repudiation	47,9%	8,3%	56,2%

### B. Application Delivery Chain

Cloud based applications are based on complicated and extended delivery chain, which involves, components that cross the geographic organizational and boundaries. The performance of the delivery chain can directly effect on process on ecommerce companies. In this case, e-commerce sellers are relinquishing control of end user experience. When cloud service providers are unable to quickly provide of these composite applications in the application delivery chain, the end user will face difficulties in service retrieval.



Figure1: Application Delivery Chain

### C. The cost of cloud break down

The failure in cloud services is highly affective. In April 2011, Amazon EC2 experienced an unexpected four days outage in cloud services, which had affected millions of end users, cost ecommerce companies and online retailers incalculable revenue and damage in brand [5]. Although the effected e-commerce companies had a serious damage in their business and reputations, this event did not violate Amazon services level agreement because of the loose and unclear language of the SLA. In this case, the ecommerce website visitors won't know and don't care who's at fault. Instead, user will start blaming the e-commerce company. Thus, the result is dissatisfaction from the e-commerce site visitors that resulted to loss of customers and revenues.

## III. RELATED WORK

There are many studies that had been conducted on the use of SLA framework in cloud computing environment. Some models proposed are in order to maintain the reliability among cloud providers and consumers involved in the negotiation process. Some studies focus on the revenue and Quality of Services. In this study, some existing SLA frameworks were reviewed and used to propose the B2C ecommerce cloud SLA framework.

[9] proposed a mechanism to manage SLAs in a cloud environment by using Web Service Level Agreement(WSLA) framework ,which has been developed for monitoring and enforcing SLA in a Service Oriented Architecture (SOA).The proposed framework are for the purpose in managing cloud consumer and provider SLAs based on the WSLA specification, they argue that consumers move toward adopting the Services-Oriented-Architecture(SOA), which lead to the importance of the service quality and reliability. The nature of consumer demand makes the simple "measure and trigger" process is hard. The main reason of using WSLA in this management mechanism is because of the flexible architecture for management SLAs between services provider and

consumers. The main problem of this framework is that it does not support the whole SLA lifecycle. The other problem of this framework is that the negotiation process considered outside of the framework. [10] also used WSLA which introduced by IBM to propose a framework for SLA management in cloud computing environment. The framework based on WSLA which provides SLA negotiation language and framework management the limitation of this framework is that it does not provide list of appropriate parameters. Instead, it only mentioned the Availability as an important parameter in the context.[11] proposed a framework for cloud SLA management named LoM2His, which is a subset of FoSII (Foundations of Self-governing ICT Infrastructures) project[12].The framework aims to map the low-level resource metrics to High-level SLA parameters. The framework just supports the monitoring and enforcement parts of the SLA lifecycle.

[13] proposed a conceptual framework for SLA in cloud computing but it did not mention anything on SLA framework management but only proposed the SLA parameters in cloud environment. As [14] pointed out that SLA attributes are different for the different of services demnads. However, due to the lack of standardization of SLA and no refferal is provided, it became difficult for consumers to compare between the cloud service providers. Hence, selecting the most reliable services provider becomes a big challenge. [15] introduced a conceptual platform of SLA in cloud computing. In this platform, they proposed a Reputation System for evaluating the reliability of providers, and also propose a SLA template pool in order to make the SLA negotiation process between cloud providers and cloud consumers more fair and transparent services. Cloud provider can advertise their services in the platform where the consumers can find the services which meet their demands. The problems in this paltform is that is under the cloud provider and the process of register the cloud provider to advertise thir services seems impractical in the real word systems. The table above concludes the existing SLA frameworks thier components.

Table 2: Existing SLA farmework view of component in SLA.

Framework		Components in SLA lifecycle					
Author	Year	Definition	Negotiation	Deployment	Monitoring	Management	Termination
Patel & Ranabahu	2009			•	•	•	
V. C. Emeakaroha, I. Brandic & M. Maurer	2010				•	•	
M. Alhamad, T. Dillon & E. chang	2010		•				
M. Wang, X. Wu, W. Zhang & F. Ding	2011		•		•		
M. Torkashvan & H. Haghighi	2012	•	•	•	•	•	•

#### IV. DERIVATION OF CLOUD SLA PARAMETERS AND OBJECTIVES

Service-level agreement (SLA) is a negotiated document which describes the level of service expected by a customer from a services provider based on metrics or policies by which that services are measured and the remedies or penalties, if any, should the agreed-upon levels not be achieved[16]. SLA records the common understanding about the services provided, responsibilities, priorities and warranties[17]. The main goal of establishing services level agreement had recently changed from being only financial contract into a tool for managing the expectations of customer [18]. However, to manage customer's expectations, it needs clear definition of services, suitable measuring parameters and objectives to measure the level of the services. In cloud computing environment, the computer resources and infrastructures offered in a scalable way where, the platform, software and infrastructure provided in form of services, which can be accessed anytime, anywhere, However, provisioning this paradigm of cloud services required specific services level agreement.

The parameters used to measure and manage performance compliance to SLA commitments are the key of successful agreements and are a critical long term success factor[19]. However, most of cloud service providers focus only on small set of parameters, namely Availability, request completion rate and response time.[20] conducted a study to break down the Cloud SLA into easy and understandable components and compare the SLAs of the considered public

cloud provider. By comparing the SLA of Amazon, Rackspace, Microsoft, Terremark vCloud Express and Stom on demand, the study highlighted that none of those providers offer any performance guarantee for the services nevertheless, none of the providers automatically credit the consumer for SLA violation, consumer should detect the SLA violation. The problems and unfulfilled expectations during accomplishing the SLA are the result of , poor choice of parameters[19].

TABLE 3: Deriving the main parameters for e-commerce cloud SLA framework

Parameters	Description	Citations
<b>Availability</b>	The uptime of the services for the user in specific time	[20-21] [13] [22] [23] [24] [25]
<b>Scalability</b>	Ability to increase and decrease the storage space	[25] [22] [13]
<b>Portability</b>	the services working on different devices or different platforms	[25] [22] [13]
<b>Performance</b>	The duration of time to respond on user's requests	[21] [24] [22] [13] [20] [26]
<b>Security</b>	The security of user data and the safety of the environment in the cloud	[21] [22] [13]
<b>Reliability</b>	Services ability to operate over the time without failure	[25] [22] [13]
<b>Usability</b>	The ability of the service to be attractive ,understandable, learnable, operable	[22] [25] [13]
<b>Backup&amp;Recovery</b>	How the Service store the image of user data and the ability to recover data in disaster.	[21] [13] [20] [26]
<b>Data location</b>	Availability zones in which the data are stored	[13]

In the context of ecommerce cloud, to alleviate the risks and challenges mentioned in section 2, Table 3 identified the most appropriate parameters which should emphasized during the negotiation process between the cloud provider and ecommerce consumer. The table describes the extracted parameters for E-commerce cloud SLA, which can be used for Managing and monitoring the Quality of services delivered by cloud providers.

#### A. Objectives of parameters

##### 1) Security :

a) **Authenticity**: trusting that the indicated identity of a subject is true.

b) **Data Integrity**: is the impossible change or deletion of data by unauthorized subjects.

c) **Data Confidentiality**: The access to data is given only to authorized user, the unauthorized individuals are denied to access confidential data.

d) **Privacy**: The ability of services to control sharing personal information.

##### 2) Performance :

a) **Response time** : The duration of time between sending a request to a service and receiving a response from the services back to the user.

b) **Throughput** : the amount of request which the services can handle in certin time.

##### 3) Reability :

a) **Service Reliability** : the service does operate correctly with transactions preserving data integrity and if it fails it reports failure to the user.

b) **Message Reliability**: the services typically communicating with each other or with consumers through messages.

#### V. E-COMMERCE CLOUD SLA FRAMEWORK

In this section we introduce our proposed SLA framework for ecommerce cloud and how the it supports the whole SLA lifecycle.

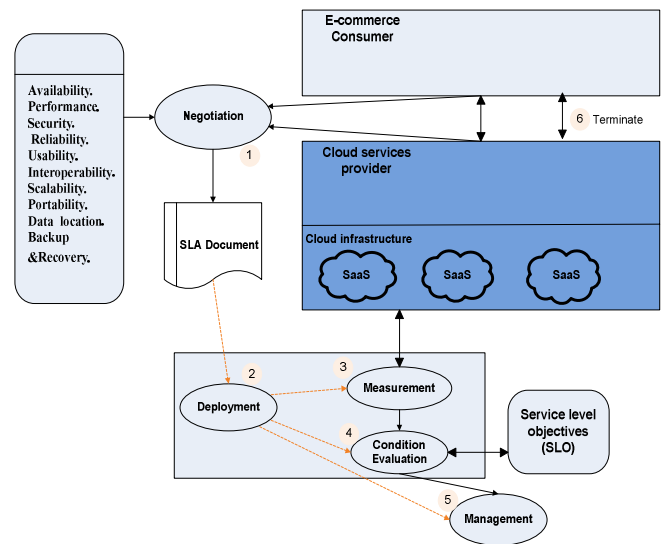


Figure 2: E-commerce cloud SLA framework.

The framework supports the SLA life cycle; the SLA lifecycle according to [27] consists of six components (Definition, Negotiation, Deployment, Monitoring, Management and Termination ) as shown in figure 3.

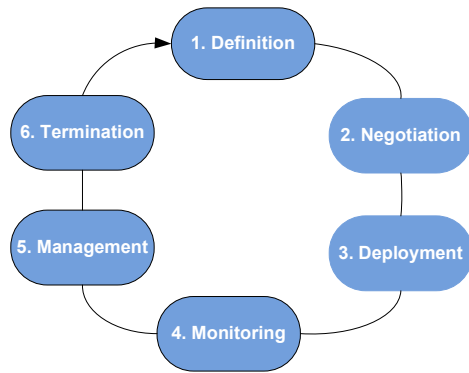


Figure 3: SLA lifecycle

In this framework, step (1) a definition and negotiation between cloud provider and e-commerce consumer, the importance of this step is that the e-commerce consumer provide the parameters with the objectives which should be included in the SLA document to consider the end user perspective. Then after the negotiation, SLA document will be deployed in step (2); which covers monitoring, condition evaluation and management. The measurement step (3) is used to measure the runtime parameters of the provided services. Based on the date provided from the measurement services, condition evaluation in step (4) checks where the parameters is over/equal/under the Services level Objectives(SLO) which are defined for the SLA parameters.

Step (5) refers to the situation if there is violation in the cloud services, the management services applies the suitable action against this situation such as penalty or invoking alternative services, based on what the SLA document states. Step (6) represents the termination process between the two sides. The framework bridges the gap of separating the parameters from the main process of SLA framework, and allow ecommerce cloud consumer to select the best services provider, which can fulfill the requirements based on the end user perspective.

## VI. CONCLUSION AND FUTURE WORK

In conclusion, Services Level Agreement is an effective way to ensure high quality of services provided. Considering the end user perspective during conducting the SLA with cloud with provider can provide holistic guarantee for e-commerce cloud user to access and interact with cloud services safely. In cloud computing, cloud consumer with clear SLA parameters and good negotiations process can trust and increase the reliability of cloud provider. In this paper we have introduced SLA framework for the ecommerce cloud, the framework covers the whole SLA lifecycle with some extension and changes to fit the ecommerce cloud. In addition, we have provided the most appropriate parameters and objectives which should be included in the SLA to consider the end user perspective. In this stage of our research, we validated the proposed SLA parameters and objectives of our framework. And as future work, according to the agreed parameters we are going design SLA document structure using XML language and we will test the whole framework components.

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