# The SLA Framework Based on Cloud Computing

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***Abstract*—Service Level Agreement was put forward to protect the service quality of telecommunications. With the development of science and technology, users are increasingly concerned about the service quality of cloud computing. Service Level Agreement is not limited to the telecommunications industry. Cloud computing Service Level Agreement become effective means to protect the cloud service quality. Analyze the specific contents of Service Level Agreement, summarize the Service Level Agreement framework and give a cloud service instance appliance in SaaS model.**

***Keywords- SLA; framework; cloud computing; SaaS***

## I. INTRODUCTION

Fierce competition in telecommunications industry makes Service Level Agreement (Service Level Agreement, referred to as SLA) appear. In order to guarantee the Quality of Service(Quality of Service, referred to as QoS), users and service providers signed SLA. With the development of network, the concept of SLA is not limited to the telecommunications. In cloud computing environment, the QoS requirements of users are higher and higher. SLA has gradually become a powerful tool for the service providers to obtain users in IT industry.

With the rapid development of computer hardware and software, calculation model is constantly evolving. Cloud computing model is proposed with a great significance, however a cloud computing environment still exist hidden dangers, for example, Google Docs productivity suite failed in September 2011 and individual users and business users were all affected. Thus, cloud computing development is not mature and users need cloud computing SLA to regulate the behavior of cloud service providers to protect interests of the user data.

Due to the cloud service providers are different, they provide different services, the needs of users change and market competition changes as well. So service providers need to redefine the SLA every time. It increased the unnecessary labor force and influenced the SLA development process. Therefore, a unified framework of SLA is necessary. Service providers can be more clearly and list the specific terms and conditions.

## II. SLA INTRODUCTION

SLA was originally proposed for ITU-T to manage with the QoS of telecommunications. It is an agreement reached through formal or informal consultations by service providers and users and the details on the aspects of service objects of key services and the responsibilities of both parties. It is the standard for telecommunications service evaluation. For IT services, SLA is the agreement reached between IT service providers and users, which contents contain service responsibilities and obligations of both parties, the service quality and so on. Agreement is generally based on the user experience and to describe services in nontechnical language. In the agreement stipulated service period, it can be used as evaluation and adjustment standard for IT services.

## III. CLOUD COMPUTING

Cloud computing is a model for the use of IT resources, it provides ubiquitous, convenient, on-demand network access to public sharing of configurable computing resources(e.g., network, servers, storage, applications and services). Do not need a lot of management costs, use and release of resources can be performed quickly[1].Cloud computing according to service type can be divided into Infrastructure as a Service(IaaS), Platform as a Service(PaaS) and Software as a Service(SaaS) three model.

## IV. THE SLA FRAMEWORK

### *A. The constitute of SLA framework*

The contents of SLA is complex, SLA framework can make the SLA contents clearly. No matter what kind of users of cloud service objects and what type of cloud service providers to provide. The SLA agreement can be made according to the SLA framework. This paper reference the ITU-T M.3342 proposal to build a SLA framework based on cloud computing[2]. As shown in figure 1, the SLA framework includes the following four aspects:

Service property: The SLA agreement related properties. It includes protocol participants, validity and scope of services.

Service information: Negotiated specific contents of related services. It includes service contents, support equipment, service standard, service change and service charge.

Service monitoring: It is the most important of the SLA and the key to guarantee the quality of the service. It includes the monitoring of service execution, the contents and methods of compensation when service providers do not meet the quality of service required by users and the inevitable natural disasters.

Service report: The service performance reports available to the users and service providers. It includes the QoS parameters specified in the SLA and statistical results.

The above contents are the whole process of statute of the SLA agreement. Service information divides the service level. The QoS parameters and thresholds are specified in SLO. SLA is the agreement on the service level set by service providers. The process measure whether the service level meet standard is the process measure whether the QoS parameters meat the threshold of service provider promised. The draft of QoS parameters should have clear definition and both parties should reach a consensus on the threshold.

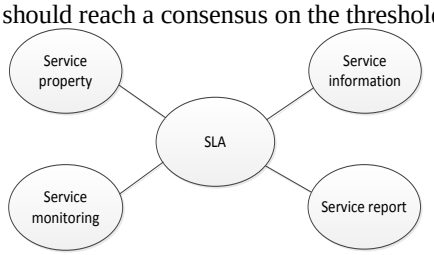


Figure1. SLA framework

*B. Detail on SLA framework*

As shown in figure 2, protocol participants represent the both parties of SLA. They include service provider and service consumer. In order to facilitate communication and contact between the two parties, both parties and their contact information should be explicitly mentioned in the SLA. The contact information of participants includes phone and e-mail.

Valid time refers to the effective time and failure time of SLA.

Service scope refers to the range of services provided by service providers.

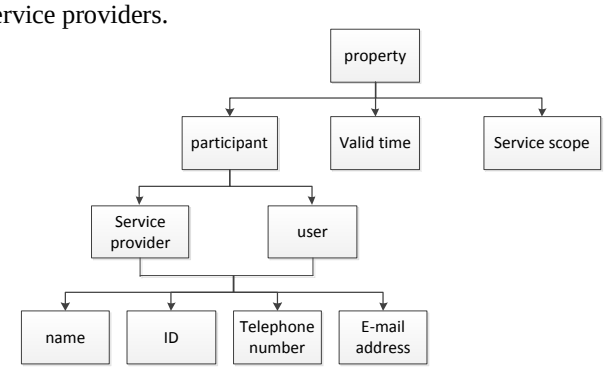


Figure2. SLA property

As shown in figure 3, Service information includes service content, support equipment, service standard, service change and service charge five parts:

Service content is a detailed description of each service. It includes three parts as follows:

Service full name: The full name of services that providers provide to users.

Service ID: The number of services that providers provide to users. Users search specified services through number.

Service description: The description of services from service provider and user.

Support equipment includes the following five parts:

Equipment name: The name of equipment that providers provide to users.

Equipment description: The complete description of the equipment that providers provide.

Power requirement: The description of the power of the equipment.

Access procedure: The procedure of the staff access to equipment installation and maintenance.

Note: The supplement and explanation of support equipment.

Service standard includes service level and service priority two parts.

Service level includes the following four parts:

Level classification: The classification of services providers provide.

Level instruction: The complete instruction of the divided level.

Service Level Object( Service Level Object, referred to as SLO) is the subject of the SLA instruction. The SLA guarantee is based on a series of SLO. SLO includes one or more service quality parameters and thresholds. A SLO implementation refers to the measured value of limited QoS parameters does not exceed the prescribed threshold range.

Service quality parameter is used to measure service quality and determine whether SLO is founded. QoS parameter is an important part of SLO and it plays the role of the scale in the SLA. QoS parameters include the following three parts:

Parameter name: The description of the QoS parameter.

Parameter ID: The number of quality parameter that service providers provide.

Parameter definition: The description of the meaning of QoS parameter.

Threshold is a range of QoS parameters that set by service provider and user.

Note: The complement and description of the service level.

Service priority includes the following four parts:

Priority classification: The classification of service priority that service provider provide.

Priority instruction: The description of the divided service priority.

Priority indicator: The instruction of the service priority indicator.

Note: The supplement and explanation of the service priority.

Service change refers to the user put forward to change service content and ways according to their needs. Both sides of SLA reach an agreement as a new protocol and perform their duties according to the new agreement after the user made the change request. Service provider should make suggestions to the user for the feasibility of the service request and value and adjust their service structure and

service personnel according to the user requirements. Service change includes the following four parts:

Change time: The time that user put forward to change the demands.

Change scope: The description of the scope that the users allow to change.

Description of change content: The specific expression of the contents of the user needs to change.

Note: The supplement and explanation of service change.

Service charge is based on certain principles and service level. It includes the following three parts:

Charge method: The description of the charge method of the services that service provider provide. For different types of business model, different methods of service charge should be taken according to the different business characteristics.

Charge cycle: The description of the cycle of the charge.

Charge notification: The description of the send way of the bill.

Note: The supplement and explanation of service charge.

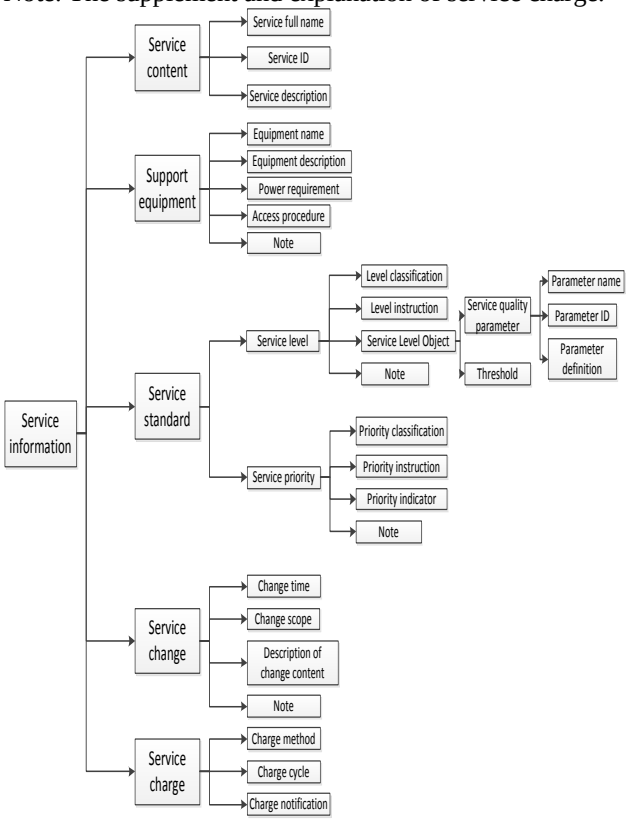


Figure3. SLA information

The SLA can always get effective guarantee unless the service monitoring and violation detection throughout the agreement. Service monitoring includes monitoring and detection, violation compensation and natural disasters three parts. Only through the monitoring of service execution, the interests of users can be protected. As shown in figure 4, service monitoring and detection includes the following three parts:

Surveillance method: The methods of monitoring all the necessary services.

Detection mechanism: The description of the testing process and mechanism of failure time.

Note: The supplement and description of the service monitoring and detection.

Offenses and compensation is measure taken when service provider do not complete commitment. It usually embodies in the form of fines and discount. It includes the following three parts:

Violation instruction: The description of contravention of the ordinance.

Compensation description: The description of the compensation when service providers do not complete commitment.

Note: The supplement and description of the violation and compensation.

Exception is irresistible factor. It is description of the situation that human could not guarantee or implement. Compensation of the service provider can be exempted when the exception occurs. It includes the following four parts:

Exception instruction: The specific instruction for exceptions, such as natural disasters and the hacker attacks.

Backup procedure: The description for data and application backup procedure.

Restore data: The description of the service parameters.

Note: The supplement and explanation of the irresistible factors.

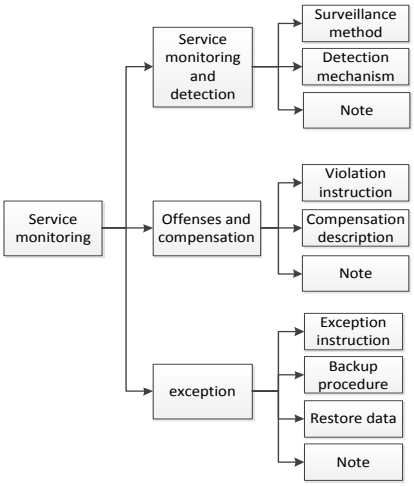


Figure4. Service monitoring

Service report contents are service quality parameter data and statistical results in the SLA. It is sent to service provider and users as a basis to assess the quality of service. As shown in Figure 5, the service report includes the following four parts:

Report cycle: The description of the service performance report cycle.

Report content: The description of the service performance report content. It contains QoS parameters and statistical results.

Report transmission mechanism: The description of the service report transmission mechanism.

Note: The supplement and description of service report.

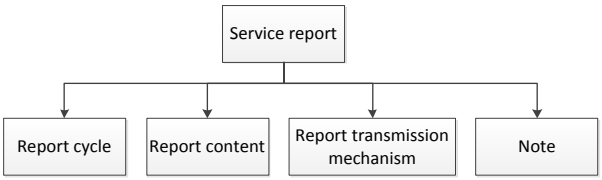


Figure5. Service report

SLA framework refers to the SLA research on Tele Management Forum. Service property contains description of the service basic information. Service information is described in detail from two aspects of users and service providers. SLO is the main part of service information. Service quality parameters and the threshold are basis of service monitoring. Service monitoring is an important part in the process of SLA negotiation. Violation compensation ensures fairness, legitimacy and effectiveness of the SLA agreement. There is important significance to establish the mechanism of rewards and punishments fair and maintain user rights. Service report is necessary, because the report guarantee the integrity of SLA agreement. It is an important basis for the two sides of the agreement changing the policy and agreeing on the content. Therefore, the QoS report added to users and service provider has great significance.

## V. EXAMPLES OF SLA FRAMEWORK APPLICATION

Online game is a SaaS service. Service providers provide online service to users as an example. Agreement made according to the framework of SLA. Take the space limitations into consideration, only elaborate agreement from two aspects service properties and service information.

TABLE I SLA framework instance-service property section

| service participant | | | |
|---|---|---|---|
| user | | service provider | |
| user name | cust1 | provider name | prov1 |
| user ID | 1 | provider ID | a |
| user telephone | 3889343 | provider telephone | 3996232 |
| user E-mail address | cust1@126.com | provider E-mail address | prov1@126.com |

TABLE II SLA framework instance- service level object section

| Service Level Object | | | |
|---|---|---|---|
| service quality parameter | | | threshold |
| parameter name | parameter ID | parameter definition | data range |
| availability | a1 | the capacity of system to provide services within the specified time | not less than 96.0% |
| the implementation rate of support demand | a2 | the response processing time for individual demand | 95% |

TABLE III SLA framework instance-service priority section

| service priority | | | |
|---|---|---|---|
| priority classification | priority instruction | priority indicator | |
| | | the average recovery time(hour) | external fault average response time |
| Level one | The classification according to the degree of the effects of emergency classification | 2 | 1 |
| Level two | | 4 | 2 |
| Level three | | 8 | 4 |
| Level four | | 16 | 8 |
| Level five | | 24 | 12 |

Table 1 from the service property section expounds the SLA agreement. Table 2 and 3 from the service information section describes the agreement. Due to the large capacity in service information, the entire contents of service information are not reflected in a table. We can see from the above table, SLA framework is clear and easy to operate. Make cloud computing SLA through the SLA framework. The complexity and repeatability of SLA is simplified and the efficiency of the formulation SLA is improved.

## VI. SUMMARY AND OUTLOOK

This paper briefly introduces the SLA. It uses SLA as the research object to analyze and expound the SLA framework and makes cloud computing SLA in SaaS model as an example of the SLA framework for experiments. According to the SLA framework, the level of standardization of SLA and the efficiency for SLA establishment are improved.

In present, the study of cloud computing SLA is still in its infancy. Cloud environment studies of SLA framework is just the beginning of cloud computing SLA research. Many concrete problems in SLA have not been solved. Such as the selection of QoS parameters, the implementation of the service monitoring and testing and the backup and recovery of cloud data for preventing the natural disaster. These contents are all the key points of the next research.

## ACKNOWLEDGMENT

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## REFERENCES

[1] Cloud Computing.http://csrc.nist.gov/groups/SNS/cloud-computing/

[2] ITU-T Rec M.3342.Guidelines for the definition of SLA representation templates[S].2006.

[3] ITU-T Rec E.860. Framework for Service Level Agreement[S].2002.

[4] ITU-T Rec M.3208.1.TMN management services for dedicated and reconfigurable circuits network: Leased circuit services[S].1997.

[5] TMF GB917-3 v2.1 SLA Management Handbook[S].2005.

[6] Jinzhi Zhu. “The Wisdom of the Cloud Computing”, Publishing House of Electronics industry, pp.59-64. (In Chinese)

[7] Jian Zhang. “The Study of Cloud Computing Service Level Agreement”, Telecommunications Network Technology, 2012. pp. 59-64.

[8] Ruoying Zhang, Xuesong Que, Luoming Meng. “The Said Method and Application of SLA”, Journal of Beijing University of Posts and Telecommunications, 2003. pp. 13-17.

[9] Chunfang Zhang, Honghui Li, Qixian Wang, Wenhui Sun. “ Service Level Agreement Research and Its Implementation Model”, Research on Application of Computer, 2005. pp. 69-71.