A Framework of Cloud service Quality Evaluation System –
Focusing on Security Quality Evaluation

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Abstract

Cloud service, a new internet business, is expected to lead the innovation of paradigm and continuously grow as a future growth engine, but various barriers are occurring that hinder the vitalization of the business such as security, cost, backup, performance and reliability related to the service adoption and usage. In the current circumstance where alleviating the market barriers in advance is desperately needed to adopt and spread cloud service, this paper proposes a framework of cloud service quality evaluation system that allows users to select cloud services with confidence. This paper focuses on security quality of cloud service quality evaluation system. Especially, the requirements of security quality for inspecting and monitoring the security vulnerabilities are defined and specialized in virtualization layer of cloud service infrastructure. The outcomes of this paper are expected to be used as guideline to develop the cloud service quality evaluation system. It also provides the cloud service quality evaluation procedures and tool development method.

Keywords: Cloud Service, Quality Evaluation System, Security, Framework

1. Introduction

Cloud computing is a concept of freely using third party infrastructure like personal computer rather than a company establishing its own infrastructure to use the system. As a latest internet business and a future growth engine that lead the innovation of ICT paradigm, it is expected to grow continuously. However, there is a significant concern among users for sudden service interruption or error due to the characteristic of user data being stored and managed in the server of cloud service provider. Additionally, there is a concern for confidential information that is being stored externally being leaked, as well as dependency that results from lack of compatibility between cloud systems [1].

Figure 1 shows the research result on barriers while adopting cloud service and these barriers must be alleviating in advance to adopt and spread cloud service.

This paper proposes a cloud service quality evaluation system framework to provide criteria for selecting cloud service in confidence according to respective need by providing objective and quantitative comparison & evaluation result on cloud service.

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for users. This paper will focus on security quality evaluation of quality evaluation system, specifically the definitions of requirements to deduce security quality requirements for inspecting and monitoring the security vulnerabilities in virtualization layer specialized for cloud service infrastructure system differentiated from non-cloud service infrastructure system to development cloud service security quality items.

Accordingly, cloud service quality measurement areas will be defined to deduce cloud service quality evaluation items. In addition, a cloud quality evaluation system framework will be developed focusing on security quality evaluation to provide help in selecting cloud service according to user requirements.

2. Cloud Service Quality Measurement Area

Quality evaluation measurement tools for existing IT infrastructure system have already been developed and being operated. In the area of software, quality management is being implemented to consider common issues such as lack of compatibility between computer types and models, lack of portability to other systems, familiarity of emphasizing user convenience, issue of users easily learning about software and software product trouble [3, 4]. In the area of network, objective and fair information on internet quality is being provided to users through internet speed test, internet phone test, path tracking test and web surfing connection test [5, 6].

In the area of cloud, however, international cloud services such as CloudHamony and CloudSleuth are providing performance measurement & monitoring results for certain areas of cloud system, and quality evaluation system can be established through monitoring & quality requirements deduction that is automated in the virtualization layer that is the most unique characteristic of cloud system.

Figure 2 shows the areas that compose cloud system that allows quality measurement & monitoring and quality requirements deduction in areas such as specialized network performance, system performance, security performance, service performance and SLA compliance of cloud service infrastructure system differentiated from non-cloud service infrastructure system [7].
3. Cloud Service Quality Evaluation Item

As defined in previous section, quality evaluation items specialized for cloud system have been deduced in five items, system performance, security performance, service performance, network performance and SLA compliance, as shown in Table 1. First off, system performance is defined as evaluating performance of the CPU computation capacity/repetition speed, Disk I/O and Memory I/O of the CPU, memory and disk of virtual resource VM. As for security performance, it is defined as examining vulnerabilities such as encryption of virtual server and latest security pack application. As for service performance, it is to evaluation the performance of applications that operate in virtual server, and response time and processing volume of each service application can be measured. In regards to network performance, packet rate, error rate, processing volume and delay time in the internal/external network of service provider can be measured. Lastly, SLA compliance is the item for measuring the status of SLA compliance provided to users by service provider and uptime/downtime, service availability and backup compliance rate can be evaluated [9].

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
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<tbody>
<tr>
<td>System performance</td>
<td>- Performance evaluation of each virtual server resource (CPU, memory, disk, etc.)</td>
</tr>
<tr>
<td></td>
<td>- CPU computation capacity/repetition speed, DISK I/O, Memory I/O measurement</td>
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<tr>
<td>Security performance</td>
<td>- Virtual server vulnerabilities inspection (application of encryption, latest security patch, etc.)</td>
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<tr>
<td></td>
<td>- Security vulnerability analysis using security vulnerability inspection tool</td>
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<tr>
<td>Service performance</td>
<td>- Performance evaluation of applications being operated in virtual server</td>
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<tr>
<td></td>
<td>- Response time, processing volume, etc. for each service application</td>
</tr>
<tr>
<td>Network performance</td>
<td>- Measurement of service provider’s internal/external network quality (bandwidth, speed, etc.)</td>
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<tr>
<td></td>
<td>- Measurement of network packet rate (%), error rate, processing volume, delay time, etc.</td>
</tr>
<tr>
<td>SLA compliance</td>
<td>- Measurement of the status of SLA compliance provided to users by service provider</td>
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<tr>
<td></td>
<td>- Uptime/downtime, service availability, backup compliance rate, etc.</td>
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</table>

The quality evaluation items deduced as previous before can be systemized into items that can be measured automatically to evaluate performance through self-diagnosis and survey research conducted for businesses and users. Since objective and quantitative evaluation results should be presented in the quality evaluation system proposed, areas that can be automated among the evaluation items should be deduced and systemized [10].

Contents on the development of quality evaluation system framework will be described focusing on security performance. First off, security quality scope is defined for the deduction & definition of security quality requirements specialized for cloud service infrastructure system. Next, security requirements of virtualization layer are analyzed and a framework is proposed to deduce evaluation index for the areas that can be systemized.

As for security quality evaluation, its scope is defined as cloud virtual infrastructure resource differentiated from non-cloud system, namely, software, network, and host server of VM. For defined security quality scope, analysis is conducted for requirements such as latest technology research & security threat element research and security threat countermeasure analysis. Based on these, basic considerations such as cloud related policy & standards and guidelines, as well as business considerations such as legality, business sustainability and resource management are deduced along with technical security and operational security items.

![Figure 3. Security Quality Evaluation Framework](image)

As for cloud system related security items deduced through above process, they are software warranty, host & VM security, network security, user authentication & access control and key management, and security quality evaluation items for host & VM are deduced since the security quality scope specialized for cloud system has been defined as virtual resource. Among the host & VM security quality evaluation items deduced, items that can be automated can be deduced for systemization. Figure 4 can be seen as a deduction of items for established system through automation for areas according to cloud system characteristics based on the analysis result of security quality requirements through the security quality evaluation system framework developed.
5. Conclusion

In the midst of current circumstance where the need to improve the quality of cloud service provider is increasing that can be trusted and meets the enhanced need for information of cloud service users, this paper proposed a cloud service quality evaluation system framework to promote the revitalization of domestic cloud service and induce the voluntary reinforcement of quality competitiveness of cloud service businesses. Accordingly, it defined quality evaluation areas specialized for cloud that is differentiated from non-cloud environment, and deduced quality evaluation items to develop a cloud service quality evaluation framework.

The result of this paper can be used as a framework to develop quality evaluation system such as the development of cloud service quality evaluation procedure & tool, and it is expected to contribute to ecology revitalization through the reinforcement of technology and service competitiveness in the area of cloud.

As for the limitations of this study, study was conducted focusing on IaaS, namely, cloud infrastructure system, although cloud service provision areas are classified variously such as IaaS, PaaS and SaaS. In addition, it proposed a framework for developing quality evaluation system focusing on security among deduced items for IaaS quality evaluation, and it is necessary to conduct studies in the future on areas such as system performance, service performance, network performance and SLA compliance. Furthermore, studies on the development of quality evaluation system are needed in the areas of service provision such as PaaS, SaaS, etc. In addition, it will be able to propose a framework for developing a clearer cloud quality evaluation system develop through continuous studies that reflect the fast-changing IT service provision environment.

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