Research on Cloud Service Reliability Evaluation Model from the Perspective of Equal Protection 2.0

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Abstract. In the era of equal assurance 2.0, network evaluation has brought great challenges to enterprises, institutions and evaluation institutions. The evaluation framework of cloud service reliability is proposed, which is divided into four characteristics: accessibility, continuity, recoverability and data backup, and further divided into sub characteristics of mutual correlation and combination of subjective and objective. It provides a measurement method for each sub feature. The evaluation results are obtained by processing and calculating.

1. Introduction

In 2019, the network security level 2.0 standard was released, including cloud computing, Internet of things, mobile Internet, industrial control, big data, etc. into the evaluation system. Cloud computing is a major technological progress in the Internet era. The gradual application of cloud computing has greatly optimized the operation efficiency of computers, reduced the operating costs of enterprises, and promoted enterprises to maximize profits. While cloud computing brings the ultimate application to the majority of users and enterprises, there are also obvious security problems, and the network security trust crisis is developing continuously. The etc 2.0 evaluation system puts forward detailed cloud security evaluation indicators and requirements, but there are no detailed provisions in the specific evaluation implementation details. Each evaluation company is also trying to explore more scientific cloud security evaluation methods, especially the evaluation of cloud service reliability. Therefore, this paper proposes a cloud security evaluation method based on classification statistics and hierarchical variable weight, which can effectively solve the problem of cloud service reliability evaluation in the practice of equal guarantee evaluation.

2. Reliability Evaluation Framework

The key to measure the quality of cloud service is reliability. Whether the cloud service can be provided continuously and reliably is not only the core consideration factor for users to choose and use cloud service, but also the important basis for cloud service resource scheduling optimization strategy. Combined with the international standards, evaluation indicators and reliability research results in the field of cloud computing, the reliability evaluation framework is divided into four characteristics: accessibility, continuity, data backup and recoverability.

Accessibility refers to the degree to which cloud services can be accessed and operated when they need to be used. The characteristics involved include cloud service accessibility rate, cloud service content achievement rate, cloud service plan and compliance, and timeliness of cloud service request response. Continuity refers to the extent to which cloud services are continuously provided in SLA according to regulations. The characteristics involved include average repair time, longest
modification time, emergency readiness of key business, failure rate and fault repair rate. Recoverability refers to the degree to which cloud services can recover to the service level agreed by SLA when a disaster occurs. The characteristics involved include the duration of disaster recovery, the node of disaster recovery and the plan of disaster recovery. Data backup refers to the degree to which CSC's data is backed up according to the requirements, including backup frequency, backup data storage cycle, backup data version number, backup data recovery test, backup method, backup verification, backup recovery options and backup data storage location.

3. Reliability Measurement Method
The evaluation characteristics involved in the evaluation framework need to be further quantified. These evaluation characteristics can be summarized into subjective characteristics and objective characteristics, and different measurement methods are adopted. Subjective characteristics are measured by objective evidence provided by CSP, and objective characteristics are measured by measurement data and calculation model. The following describes the measurement method for specific characteristics.

Cloud service accessibility refers to the proportion of the sum of a series of cloud services available time to the sum of predefined time periods. The achievement rate of cloud service content = the actual number of cloud service content achieved / the number of agreed cloud service content. The value of non-compliance and non-compliance is 8.0.0 according to the level of detailed review. The value rule of timeliness of cloud service request response is as follows: timely processing and providing processing result value is 1, value of timely processing and proposing solution is 0.8, value of timely processing and timely response is 0.6, value of timely processing but not providing response is 0.4, and value of not timely processing is 0.

Average repair time refers to the average time taken to change from a failure state to a cloud service state that can provide the agreed level. The longest repair time refers to the longest time spent in the cloud service repair operation. The rule of critical business emergency readiness is: the emergency plan is ready and can be implemented with reasonable assessment scheme and implementation assessment value is 1; the value of emergency plan ready and executable with reasonable assessment scheme but not implemented is 0.8; the value of emergency plan ready and executable but no assessment scheme is 0.6; the value of emergency plan ready but not executable and no assessment scheme is 0.6, the emergency plan is ready but can not be implemented and there is no assessment scheme, the value is 0.2. Failure rate refers to the probability of cloud service failure in a specified period of time. Fault repair rate refers to the ratio of the number of repaired faults to the total number of faults in a series of cloud service failures.

Disaster repair time refers to the longest time required for cloud services to continue to provide the agreed level of cloud services after a disaster. The rule of disaster recovery node refers to the longest time from the time of disaster to the time when the disaster occurs and the data content is lost after the disaster is repaired. The value rule of disaster recovery plan is: there is application and data disaster recovery process, and the description is detailed and easy to operate, the value is 1; there is application and data disaster recovery process, and the description level and operability are generally 0.8; there is application and data disaster recovery process, but the description is not detailed and poor operability, the value is 0.6; the value of no application and data disaster recovery process description is 0.2.

Backup frequency refers to the number of times backup operations are performed in a fixed period of time. The storage cycle of backup data refers to the length of time that CSP saves CSC backup data in a fixed period of time. The number of backup data versions refers to the number of versions of CSC backup data saved by CSP in a fixed period of time. Backup data recovery test refers to the times of data recovery test and report generation for backup data in a fixed period of time. The value rules of backup method are as follows: the selection of backup method selection is reasonable and the description of usage method is very detailed, the value is 1, the selection of backup method is reasonable and the detailed value of method description is 0.8, the selection of backup method is reasonable but the description degree is generally 0.6, the value of backup method selection is reasonable but the description is not detailed, the value is 0.4, and the value of unreasonable backup verification scheme is 0.2. The selection rules of backup and recovery optional methods are as follows: the selection of backup
recovery optional methods is reasonable and the description is detailed, and the operability mandatory value is 1; the selection of backup recovery optional methods is reasonable and the description is detailed; the value of operability is 0.8; the selection of backup recovery optional methods is reasonable, but the description is generally 0.6; the value of backup recovery optional method is reasonable but the description is not detailed, and the value is 0.4 The optional method of backup and recovery is unreasonable, and the value is 0.2. The rules for the value of backup data storage location are as follows: with backup storage location and the reasonable value of location is 1; with backup storage location and part of the location is reasonable value is 0.8; with backup storage location but the location setting is not reasonable, the value is 0.6; the value of non backup storage location is 0.2.

4. Implementation of Reliability Evaluation

In order to avoid the influence of zero quantity on the follow-up operation and research, the minimum evaluation value is set as 0.2. There are no unit characteristics in the reachability rate, content achievement rate, fault repair rate and fault occurrence rate, and the values are between [0,1], so dimensionless and normalization are not needed. The evaluation results of the first three items are their measurement values. The difference between the evaluation result of the failure rate and the measured value is 1. The evaluation results of each sub feature are weighted, and the calculation formula is shown in expression 1.

\[
\rho = \sum_{x=1}^{m} \omega_x \rho_x + \sum_{y=1}^{n} \omega_y \rho_y + \sum_{z=1}^{p} \omega_z \rho_z + \sum_{h=1}^{q} \omega_h \rho_h
\]  

(1)

Where \( m, n, p \) and \( q \) are the number of sub features contained in each feature, with values of 4, 5, 8 and 3 respectively. \( \omega_x, \omega_y, \omega_z \) and \( \omega_h \) are the weights corresponding to the four sub characteristics.

The weight distribution of accessibility is 30%, the weight distribution of continuity is 30%, and the weight distribution of data backup is 25%. The weight distribution of accessibility sub characteristics is as follows: cloud service accessibility rate 35%, cloud service content achievement rate 25%, cloud service plan and compliance 15%, cloud service request response timeliness 25%. The weight distribution of continuity sub characteristics is as follows: the average repair time is 15%, the longest repair time is 10%, the critical business emergency readiness is 20%, the failure occurrence rate is 30%, and the fault repair rate is 25%. The weight distribution of recoverability sub characteristics is as follows: disaster recovery time 40%, disaster recovery node 40%, disaster recovery plan 20%. The weight distribution of data backup sub characteristics is as follows: backup frequency 25%, backup data storage cycle 20%, backup data version number 20%, backup data recovery test 15%, backup method 5%, backup verification 5%, backup recovery optional method 5%, backup data storage location 5%.

After sorting out the above cloud service characteristics, the evaluation task can be implemented. The evaluation steps can be summarized as follows: firstly, measure each sub feature; according to the characteristics of sub features, the evaluation results of sub features are normalized and dimensionless; by introducing weight, the evaluation results of each feature are calculated; according to Formula 1, the final cloud service reliability evaluation result \( P \) is calculated; when a certain sub feature is selected, the evaluation result of cloud service reliability is calculated When the value of characteristic evaluation result is cut-off threshold, it is regarded as unqualified item. If there is unqualified item, the service is considered unreliable.

5. Summary of Reliability Evaluation

In the evaluation index system of equal guarantee 2.0, the evaluation parameter dimensions are diverse and the units are not unified, which brings great challenges to the reliability evaluation. The evaluation model proposed in this paper processes and calculates the measurement results of each sub feature, and finds out the unreliable factors in the cloud service. Combined with a domestic CSP cloud storage service and evaluation requirements, an example is verified in terms of reliability. The results show that the proposed evaluation method has strong applicability and operability, and provides effective guidance for evaluation companies or users.
6. References

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