Evaluation Model for Internet Cloud Data Structure Audit System

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ABSTRACT: As economic globalization and information industry develop at top speed, Internet has penetrated into all walks of life rapid, with an immeasurable impact on all aspects of people's life. Computer technology is an integral part in the evaluation of audit system, technically prepared for application of cloud data structure in the evaluation of audit system. Based on the concept of Internet cloud data structure, this paper constructs a new audit system evaluation model. Firstly, it performs a theoretical analysis of Internet cloud data structure audit system; then it explores applications of cloud data structure audit system; finally, feasibility of cloud data structure audit system is evaluated by means of AHP and fuzzy analysis. It is found that the system has incomparable superiority in audit practices.

Subject Categories and Descriptors:
I. 2.10 [Cloud Technology]: Cloud Data Analysis; **I. 4.10 [Cloud Data]**

General Terms: Could Data Processing, Information Processing

Keywords: Internet, Cloud Data Structure, Audit System Evaluation

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1. Introduction

In recent years, the evaluation of audit system has become a popular topic in fields of international economy and management, of which the risk is considered a central issue. To build an audit system evaluation model and accurately assess risks related to the audit system will be beneficial for auditors to determine audit procedures and improve audit quality in a reasonable manner. Since audit is associated with specific historical conditions, it is bound to make appropriate adjustments as social environment varies. National Audit Standards of the People's Republic of China (Audit Office Order No. 8) is effective on January 1, 2011. Based on new audit objectives and criteria, it redefines the importance of the audit system, expanding understanding of the audit system beyond traditional data report information. [1] As audit evolves, conventional manual audit and one-machine audit can not cater to modern audit practices. With the popularity of Internet applications in all walks of life, it is an inevitable trend to use computer technology in the audit system. Development and use of cloud data structure have become an indispensable factor.

The Cloud data structure has its own advantages. It can assign computing tasks to idle computers on the entire cloud network; it is not so demanding on equipment performances on the user side and is easy to use; it supports data sharing between different devices, such as desktop computers, mobile phones and tablet computers, which can all work as the foreground of cloud data; it stores data files on the server side, with far more security and reliability in data storage compared to personal computers. Currently, China's audit system evaluation

systems or methods mostly aim at factors involved in major errors or risks in the audit process, without an effective solution to the complex relationship analysis and risk evaluation among factors of the audit system evaluation model. Therefore, it is necessary to build a new audit system evaluation model in accordance with the country's updated audit standards. This paper will examine the audit system evaluation model based on Internet cloud data structure; the evaluation results will help determine the audit focus precisely, calculate the audit structure, improve data storage security and effectiveness, and enhance audit efficiency.

2. Theoretical basis for the audit system evaluation model

Audit system evaluation model is mathematical or logical expressions established based on the data obtained by auditors according to basic features of the audit target, such as nature, number, time or space state (trend, structure, relationship, etc.) through setting conditions for calculation, determination and restriction. It is used to verify basic features of the audit target and thus make a scientific judgment on whether economic activities of the audited organization are true, lawful and effective [2]. Audit system evaluation model is algorithms that can be understood by auditors and used with computers for describing and processing, established and applied according to the actual situations. The Cloud data structure is characterized with "*on-demand self-service*", "*broad network access*", "*resource pooling*", "*rapid elasticity*" and "*measured service*", widely recognized by numerous insiders. As Shown in Figure 1.

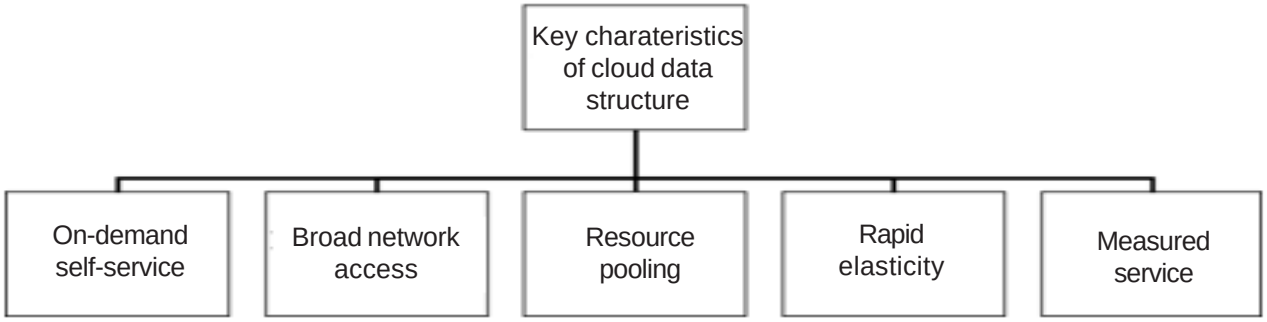

Figure 1. Key characteristics of cloud data structure

Cloud data structure is referred to as the core architecture for the next generation computer network technology by most IT companies and insiders. The concept of cloud data structure can be traced back to the 1960s when it was firstly proposed by Turing Award winner John McCarthy. In 2007 IBM pioneered cloud data computing plans, defined cloud data, and described cloud data structure as a scalable platform, which can be deployed and configured dynamically on demand. Cloud data structure platform contains a large number of computing resources, storage area networks, network infrastructures and security devices, which can deliver various cloud application services by means of the Internet.

Cloud data structure assigns tasks in the "*cloud* ", so that various application systems can have access to computer power, storage space and software services. This application or service based on cloud data structure is called "*cloud service*", specifically reflected in the following aspects: (1) SAAS (Software-as-Service) and the platform. The cloud data structure of SAAS passes on programs to thousands of users through the browser. From the perspective of users, it helps save costs, avoid spending on servers or software licenses, and waive the needs to purchase server devices or software licenses in advance. From the perspective of suppliers, only one program needs to be maintained, thus saving a lot of costs. [3] (2) IAAS (Infrastructure-as-a-Service). IAAS provides customers with capabilities to use basic computing resources in the cloud, so that users can have access to services from the complete computer infrastructures by means of the Internet. (3) PAAS (Platform-as-a-Service). PAAS means that the software R&B platform works as a service, delivers to customers the capabilities to create and customize services on the cloud and submits them to customers in SAAS mode. As an application of SAAS, it can accelerate the development of SAAS.

3. Application of cloud data structure in audit system evaluation

"*Cloud* " is divided into public cloud, private cloud and hybrid cloud. Public cloud is a WAN-oriented, composed of infrastructures from cloud data computing service providers. A Private cloud is an internal one dedicated to cloud services for an organization, which can be established separately within an enterprise. Hybrid cloud is a self-existent one consisting of two or more clouds, which offers interoperable interfaces between clouds and facilitates data and application portability. From the perspective of audit nature and safety, a private cloud is more appropriate. According to key characteristics of cloud data structure and academic research results, cloud computing architecture can be divided into 5 layers, shown in Figure 2.

3.1 Application forms of cloud data structure audit system

The main function of cloud data structure audit system lies in that the auditor and the audited have access to

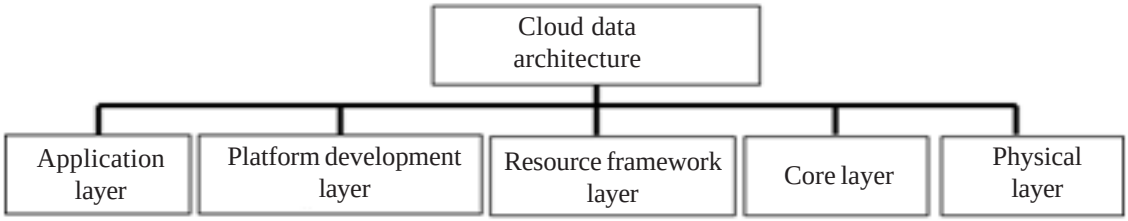

Figure 2. Five layers of cloud computing architecture

computing power, storage space and software services, and enhance the level of office automation through the cloud platform. Applications and services based on cloud computing are thereby referred to as "*cloud services*". Cloud data structure audit functions mainly include the following figure:

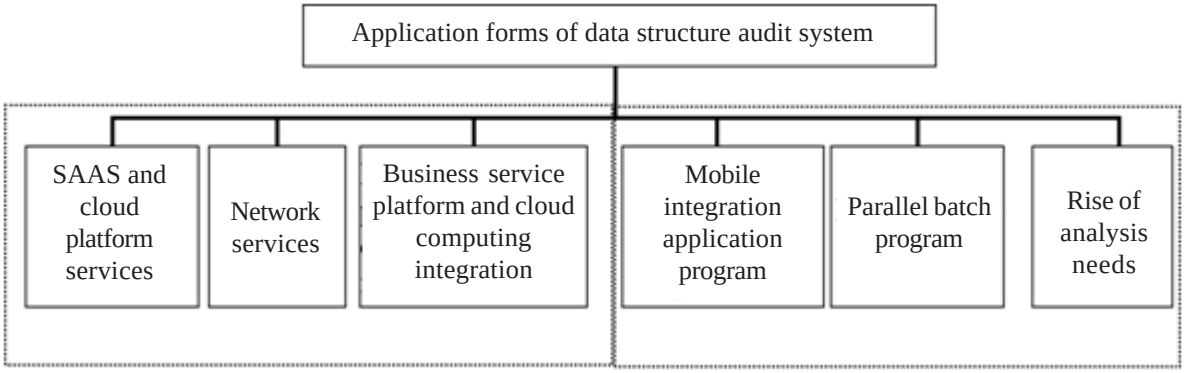

Figure 3. Cloud data structure audit functions

3.2 Application classification of cloud data structure audit system

During the audit process, applications of Internet cloud data structure audit system mainly include three aspects. Firstly, it is the audited department's application of cloud data structure audit system, shown in Figure 4 and 5. The audit department may transfer the cloud audit data collected by the audit data acquisition software installed on the cloud platform used by the audited department; then the audit department performs analysis and processing of the data, and acquires audit proof by means of cloud data. Meanwhile, the audit department may also collect data through the self-installed front-end device for database services, and perform acquisition and transfer of the cloud data from the audited department through the network. When it is allowed by the audited organization, the cloud platform may be directly used to perform audit data analysis with the cloud data analysis software as required by the audit department, so as to obtain audit proof, sent it to the audit department and thus complete the audit work.

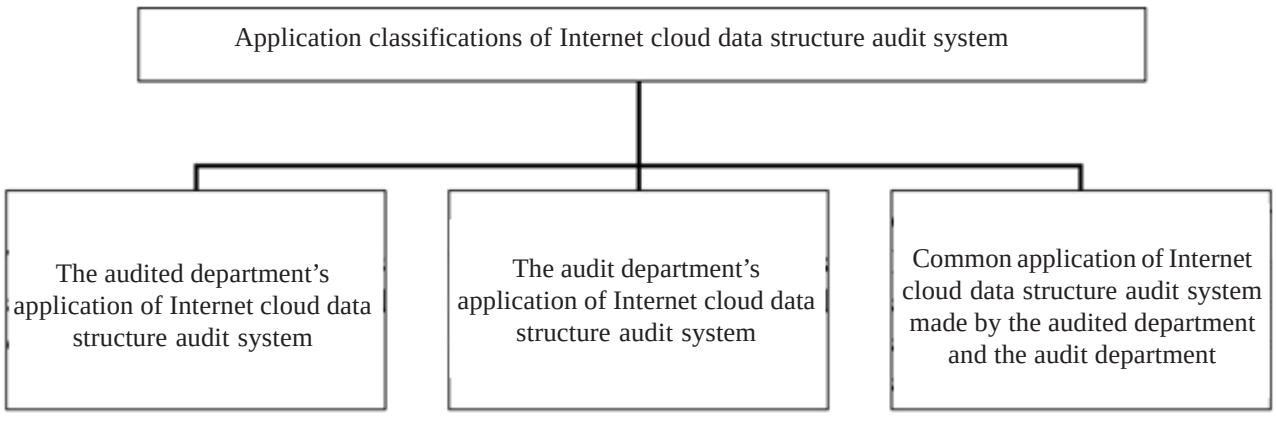

Figure 4. Application classifications of cloud data structure audit system

Secondly, it is the audit department's application of cloud data structure audit system, shown in Figure 6. Nowadays, cloud computing platform is used in some regions of the country to build an e-government. This is a major revolution in government audit department. With cloud platform services and devices, the audit department inputs and stores the cloud data collected by the audited department, and then analyzes the data by means of the cloud platform service software.

Figure 5. The audited department's application of cloud data structure audit system

Figure 6. The audit department's application of cloud data structure audit system

Thirdly, it is common application of cloud data structure audit system made by the audit department and the audited department, shown in Figure 7. The audit department and the audited department may adopt a common cloud platform or separate cloud platforms. Data transfer and acquisition request are completed through the cloud platform.

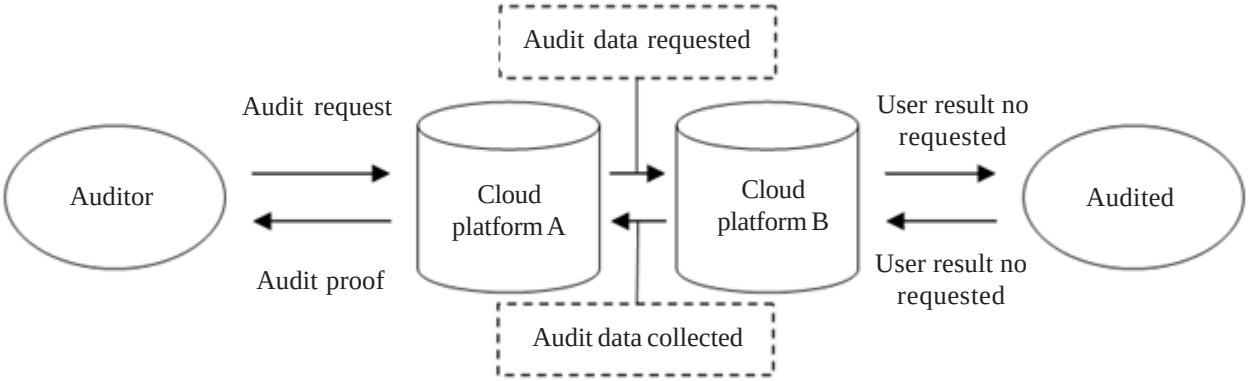

Figure 7. Common application of cloud data structure audit system made by the audit department and the audited department

4. Evaluation of cloud data structure audit system model

Based on the cloud data architecture, combined with the advantage of being more efficient and intuitive in cloud data computing process and result, 16 indicators are selected to evaluate the audit system, on the basis of full investigations and opinion collection from experts and audit targets. Based on the features of mutual interaction and influence among the factors within various grades of the audit system evaluation indicators, as well as mutual feedback among various grades, AHP and fuzzy analysis are used to build the two-grade evaluation model for the cloud data structure audit system, shown in Figure 3, and evaluate its safety. The indicator evaluation system is shown in Table 1. Evaluation level segments are divided into $v(v1\ v2\ldots\ldots vn)$ and 5 dimension according to the Likert scale, separately well, relatively good, fair, poor and very poor, valued at 95,85,75,65 and 55. Then summarizing is performed aiming at cloud data itself, audit personnel, cloud platform services and overall control using the Delphi survey method for 12 experts, and judgment matrix is obtained. [8]

For single factor evaluation weight in AHP analysis, "*logarithmic least square method* " is used for computing. Then the Z value is calculated. After normalization processing, it turns out that $W = (W1, W2, W3\ldots\ldots Wn)$).

Subsequently, vector quantity results are calculated for a comprehensive evaluation. Vector evaluation is performed to the two-grade factors, the formula $B1 = w1R1$ is used,

Audit system (C)		
1st-grade indicators	Cloud data itself (C_1)	Audit personnel (C_2)
2nd - grade indicators	Operating condition of cloud database (e_{11}) Security of cloud database (e_{12}) Cloud data service level (SLA)(e_{13}) Cloud database performance (e_{14}) Cloud data storage and attribution (e_{15})	Professional competence of audit personnel (e_{21}) Operational normalization of audit personnel (e_{22}) Professional skepticism of audit personnel (e_{23}) Risk awareness of audit personnel (e_{24})

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Table 1. Audit system evaluation indicator system

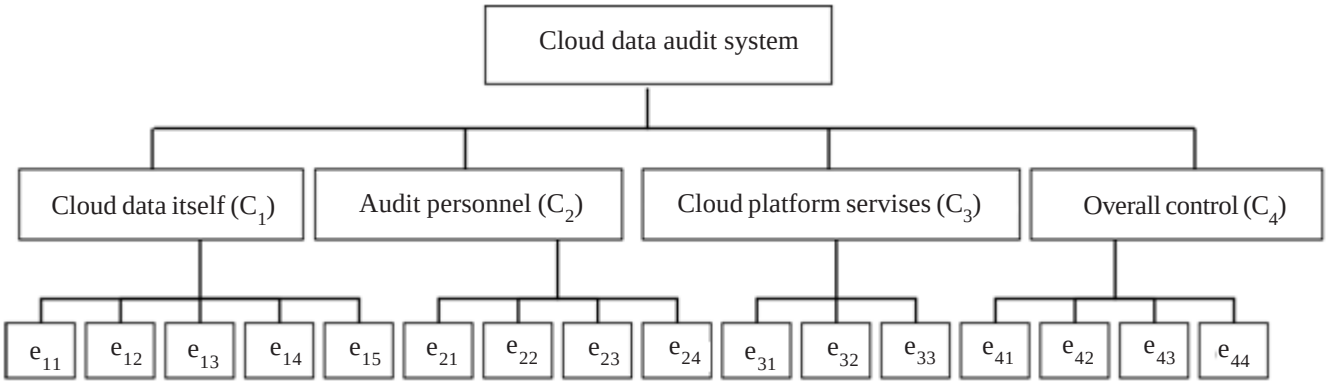

Figure 8. Cloud data structure audit system model

1st-grade indicators	2nd - grade indicators	V_1	V_2	V_3	V_4	V_5
C_1 Cloud data itself	e_{11}	0.6	0.2	0.2	0	0
	e_{12}	0.5	0.4	0.1	0	0
	e_{13}	0.6	0.2	0.1	0.1	0
	e_{14}	0.7	0.2	0.1	0	0
	e_{15}	0.5	0.3	0.2	0	0
C_2 Audit personnel	e_{21}	0.6	0.3	0.1	0	0
	e_{22}	0.4	0.2	0.1	0.2	0.1
	e_{23}	0.5	0.2	0.2	0.1	0
	e_{24}	0.6	0.1	0.2	0.1	0
C_3 Cloud platform services	e_{31}	0.7	0.2	0.1	0	0
	e_{32}	0.5	0.2	0.1	0.1	0.1
	e_{33}	0.4	0.2	0.2	0.1	0.1
C_4 Overall control	e_{41}	0.6	0.2	0.1	0.1	0
	e_{42}	0.4	0.3	0.2	0	0.1
	e_{43}	0.5	0.2	0.2	0.1	0.1
	e_{44}	0.6	0.3	0.1	0	0

Table 2. Fuzzy relationship matrix of cloud data structure audit system feasibility

and following results are obtained:

$B1 = [0.66, 0.22, 0.1, 0.02, 0]$

$B2 = [0.50, 0.20, 0.18, 0.08, 0.04]$

$B3 = [0.60, 0.14, 0.12, 0.08, 0.06]$

$B4 = [0.56, 0.24, 0.18, 0.02, 0]$

After normalization processing, C, C1, C2, C3 and C4 are respectively 89.58, 92.56, 85.35, 89.53 and 87.66. It can be seen that cloud data itself scores 92.56; audit personnel quality scores 85.35; cloud platform service scores 89.53; overall control scores 87.66. As a conclusion, Internet cloud data structure audit system is suitable for audit practices.

5. Conclusion

Based on the concept of Internet cloud data structure, this paper constructs a new audit system evaluation model. Firstly, it performs a theoretical analysis to Internet cloud data structure audit system; then it explores applications of cloud data structure audit system; finally, feasibility of cloud data structure audit system is evaluated by means of AHP and fuzzy analysis. It is found that the system has incomparable superiority in audit practices.

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References

[1] Baohou, Sun. (2010). Interpretations of New National Auditing Standards. *Audit Study,* (6) p. 3- 9.

[2] Aizhong, Shi.,Jian, Sun. (2005). Early Release Data Audit Model. Audit Study, 04, p. 3-6.

[3] Mingming, Lu. (2010). Application of Web2.0 in Education Supported by Cloud Computinga!, Software Guide Educational Technology, (31).

[4] Aymerich, F M., Fenu, G., Sureks, S. (2008). Approach to a Cloud Computing Network. Technical University of Ostrava, *In:* IEEE First International Conference on Applications of Digital Information and Web Technologies, p.113-118.

[5] Youseff, L, Butrico, M, Silva, D. (2008). Toward a Unified Ontology of Cloud Computing. Texas: IEEE Grid Computing Environments Workshop.

[6] Armbrust, M., Fox, A., Griffith, R, et al. (2010). A View of Cloud Computing. *Communications of the ACM*, 53 (4) 50-58.

[7] Chou.C.L., Du T, Lai V S. (2007). Continuous Audit with a Multi-agent System. *Decision Support Systems*, 42 (4) 2274-2292.

[8] Rittenberg, Larry, E.,Schwieger, Bradley J. (2007). Auditing- A Concept in Changing Environment, Beijing: Tsinghua University Press.