

Evaluation of the Use of Cloud Storage on Academic Website Using SWOT Analysis and Balanced Score Card

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Abstract—Data security and data leakage is an important issue in a dangerous technology in Cloud Storage systems on Cloud Computing. Academic website also faced problems like data leakage and system hacked for certain purposes. To achieve an appropriate level of data security standard on the Cloud Storage for academic website, the strengths and weaknesses in data security of Cloud Storage on academic website was evaluated using SWOT analysis. The analysis is based on four layers that exist in the cloud storage structure, namely access Cloud Storage. This is important since in recent years, many incident took place on attacks layer, application layer interfaces, management layer, and storage layer. The study also evaluates the performance of cloud storage by measuring the academic website using IT Balanced Scorecard which based on four perspectives of IT Balanced Scorecard. This study focuses only on Cloud Storage website of Academic Information System (AIS) UIN Jakarta, since many hacking incident on student accounts while there is no evaluation results on the website AIS Cloud usage.

Keywords: *Cloud Computing, Cloud Storage, data security*

I. INTRODUCTION

Cloud storage technology makes full use of the existing different storage devices in the system to provide users with data storage, data retrieval, data backup and other functions through application software ran by a user terminal. In recent years, attacks and data leakage in cloud storage system within Cloud Computing seemed to be increased [1].

In previous research,[1], use risk analysis to the 4 layers in Cloud Storage technology. The result showed that the technology developed very fast, and cloud storage security technology is facing unprecedented challenge. However, cloud storage

security is not just a technical issue. It also involves standardization, management, laws and regulations and other problems. [2], analyze safety hazards of Cloud Computing. In this analysis discussed traditional and approved security solutions and procedure evaluation parameters. It was discussed also the procedure for evaluating parameter are determined. Those will be provided as one packaged solution. [3] get the result that in multi-layer cloud network, any device can augment its resources by taking off his duties to the public cloud, private cloud, or even the user's device. However, it is difficult to handle access control on data stored in different clouds that offer variety of access control.

This research is focused on the cloud storage system UIN Jakarta Academic Information System (AIS) website. We evaluated it by using SWOT analysis approach and methods of IT Balanced Scorecard as performance measurement on the application of information technology. This research focuses on strategic objectives of the academic website with measurement dimensions variable adapted to the academic website

II. LITERATURE STUDY

A. Cloud Storage

Cloud Storage operates through a Web-based API that is implemented remotely through interaction with the infrastructure of in-house cloud storage client applications for input / output (I / O) and read / write operations (R / W) [4]. Standard Cloud Storage can help to overcome the problems of accessibility, security and portability issues and the costs associated with growing data sets [5].

The advantage of Cloud Storage in the academic field are to minimize investment costs in academic

infrastructure, to enable the development and implementation of applications quickly that is increasing productivity in the academic field, and to facilitate the integration of the academic system services with various devices [5].

B. Four Layer Cloud Storage

The structure of cloud storage system consists of four layers:

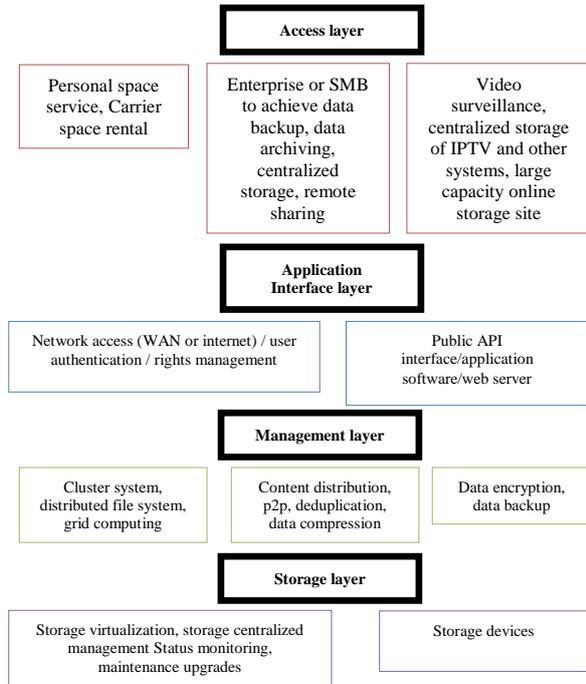


Figure 1. Layer in Cloud Storage [1].

- Storage layer**

Storage layer is the most basic part of cloud storage. The storage device can be in Fiber Channel FC storage devices. This could also be an IP storage device such as NAS and iSCSI, or direct-attached storage (DAS) devices such as SCSI or SAS.
- Management layer**

Management layer implements collaboration between multiple storage devices in cloud storage through clusters, distributed file systems, and grid computing technology. This enable multiple storage devices provide the same services and to have bigger and better data access performance.
- Application interface layer**

Application interface layer is the most flexible part of cloud storage. In the actual type of business, different cloud storage operators can develop a different application service interface, and providing a wide range of services.
- Access layer**

Each authorized user can access the cloud storage system through a standard public application interface and enjoy the cloud

storage service. The types and methods of access provided by cloud storage are the results from different operating unit.

C. IT Balanced Scored Card

Balanced Score Card (BSC) is the effective tools of performance management. It uses measurable indicators for assessing organization's implementation and strategic targets [6]. The BSC develops the four views index. They are learning and growth, internal processes, customers, and finances. BSC goal is balancing the financial target as a result of past performance, and three other indices (future display index) [7].

Table1. Four Perspectives of IT BSC [7]

USER ORIENTATION	BUSINESS CONTRIBUTION
<p><i>How do users view the IT department?</i></p> <p>Mission <i>To be the preferred supplier of information systems</i></p> <p>Objectives</p> <ul style="list-style-type: none"> Preferred supplier of applications Preferred supplier of operations vs proposes of best solution from whatever source Partnership with users User satisfaction 	<p><i>How does management view the IT department?</i></p> <p>Mission <i>To obtain a reasonable business contribution from IT investment</i></p> <p>Objectives</p> <ul style="list-style-type: none"> Control of IT expenses Business value of IT projects Provision of new business capabilities
OPERATION EXCELLENCE	FUTURE ORIENTATION
<p><i>How effective and efficient are the IT processes?</i></p> <p>Mission <i>To deliver effective and efficient IT applications and services</i></p> <p>Objectives <i>Efficient and effective developments</i> <i>Efficient and effective operations</i></p>	<p><i>How well is IT positioned to meet future needs?</i></p> <p>Mission <i>To develop opportunities to answer future challenges</i></p> <p>Objectives <i>Training and education of IT staff</i> <i>Expertise of IT staff</i> <i>Research into emerging technologies</i></p>

IT Balanced Scorecard: the outcome of measures and performance drivers [8]. IT Balanced Scorecard to provide a comprehensive and structured presentation and review. It will allow related managers to monitor the strategy of IT implementation based on the value of each IT perspective [9].

D. SWOT Analysis

SWOT is an abbreviation for Strength (Strength), Weakness (Weakness), Opportunity (Opportunity), and Threat (Threat) which is a strategic factor specific to a particular company [10]

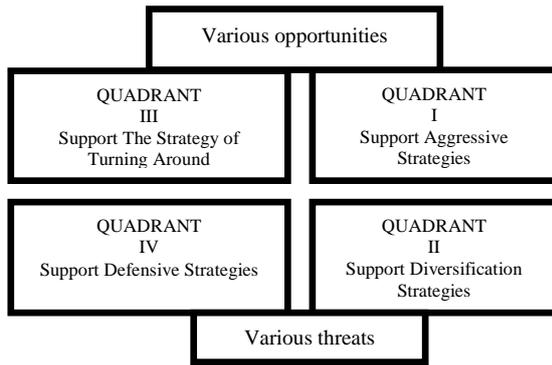


Figure 2. SWOT Diagram [11]

SWOT analysis is used to determine the position currently experienced by the company, and to determine the strategic directions can be taken by company using a SWOT Analysis Diagram. SWOT can also be used to produce a number of possible alternative strategies. The TOWS matrix (TOWS is just another way of saying SWOT) describes how the external opportunities and threats faced by a particular company can be matched with the company's internal strengths and weaknesses that can produce four possible alternative sets of strategies.

Table2. SWOT matrix [12]

INTERNAL FACTORS (IFAS)	Strengths (S) List 5-10 internal strengths here	Weaknesses (W) List 5-10 internal weaknesses here
EXTERNAL FACTORS (EFAS)		
Opportunities (O) List 5-10 external opportunities here	SO Strategies Generate strategies here that use strengths to take advantage of opportunities	SO Strategies Generate strategies here that take advantage of opportunities by overcoming weaknesses
Threats (T) List 5-10 external threats here	ST Strategies Generate strategies here that use strengths to avoid threats	WT Strategies Generate strategies here that minimize weaknesses and avoid threats

E. Academic Information System

Academic information is very important information for students. Some academic information has a certain deadline, therefore, it must be delivered to the student as soon as possible[13]. Web Services technology offers convenience of bridging information resources no matter what technology used by each source [14]. Academic information systems can clarify the academic path of students during their studies and increasing integrity and transparency by providing equal information to all stakeholders. This also adds convenience by allowing access from anywhere through web [15]. In the Academic Web, electronic resources from this organization are very informative and can be used as sources of new media for science and contribute to promote scientific knowledge [16].

III. METHOD

Method used in this study can be explained as follows:

1) LiteratureStudy

At this stage, the study was done on literature related to cloud storage, risk analysis, performance measurement, Balanced Scorecard and IT Balanced Scorecard. From the literature, it is expected to learn the description of risk analysis in the cloud storage and performance measurement of academic website using IT Balanced Scorecard

2) Data collection

Methods used for data collection was interview. Interview was conducted to the Pustipanda UIN Jakarta. The interviews is about cloud storage, cloud storage risks on the web academic, advantages and disadvantages of cloud storage academic web and how to cope if the risk occurs in the cloud storage academic web.

3) Data processing

The result of interviews with Pustipanda was compared to IT perspective Balanced Scorecard. The result constitute the basis for formulating key performance indicator (KPI) of cloud storage academic website. Then create SWOT matrix to learn the internal strengths and weaknesses of cloud storage academic website. The KPI and target that was set are mapped into four perspective of IT BSC which are contributions from organizations, user orientation, operational improvement, and future contributions.

Later each KPI was measured. Actual condition value is obtained from the following calculation: each answer on scale 1-5 is multiplied by its weight. Each result for all answer is added up. Then the total value is divided by the number of respondents. Then the total value multiplied by 20% (20% because of the scale there are 5, then 100%: 5). To calculate the weighted results using the formulation of strategic objectives as follows: 1) weight = weight value comes from the academic website management, 2) the result of interest = (result size / 100) x weight, 3) the results of the average size = result of achievement of data processing from each perspective of IT Balanced Scorecard, 4) total is the percentage of each perspective.

- Data analysis and determination of the level of performance

The measurement results are then analyzed so it can be determined which aspects are less supportive to the achievement of the strategic plan so that corrective action can be taken. Its

measurement results is in the form of scorecard that contains values to each IT perspective BSC which will determine the level of academic web performance.

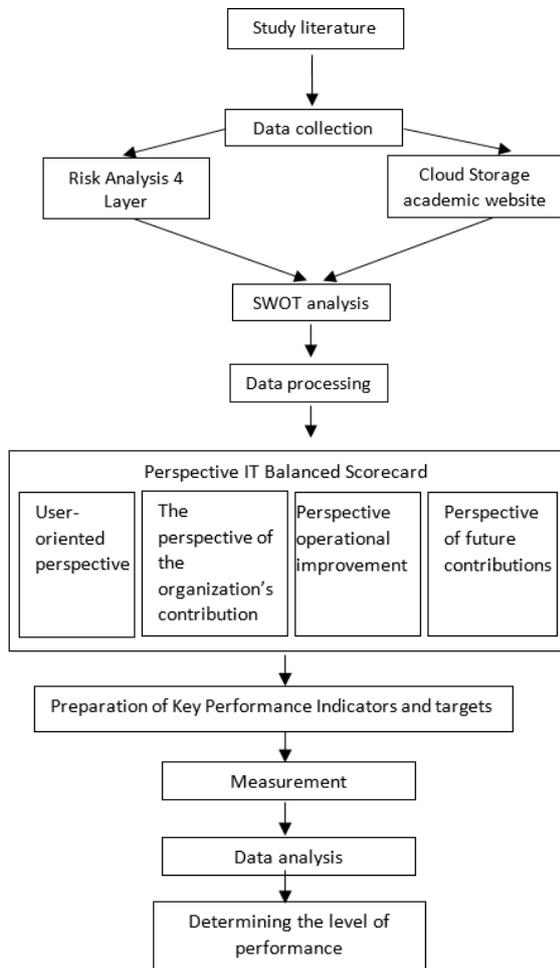


Figure 3. Research Method

IV. RESULTS AND DISCUSSION

The information system object for the research is a web-based academic information system. The function of this system is to provide data sources and academic administration that covers institution data, student data, lecturers' data, scholarship data, lecture scheduling, academic transcripts, study plan cards, study results cards, summary data, and academic transaction report for students.

Security on the academic system is good enough because the system utilize Secure Storage Layer (SSL), encrypting visitors so that it is difficult to be hacked. Programming language uses the Java language, the Linux operating system and the Tomcat service. Some anticipation if there hacked data, namely by using SSL, separating the database server, application server and streaming database server.

A. SWOT Analysis 4 Layers Cloud Storage

Cloud storage for academic website has an advantage to be accessed from anywhere.

There are some network factors need to be considered, namely 1) problem compilation related to connection of internet service provider (ISP), 2) user accessing the academic systems is increasing, 3) storage space crash the systems. Cloud storage in academic systems contain four layers. Namely, storage layer, management layer, application layer, and interface of access layer. The following is SWOT analysis for academic systems of four layers cloud storage.

Table 3. SWOT Matrix Academic Cloud Storage System

Strengths (S)	Weakness (W)	Opportunity (O)	Threats (T)
-Cloud Academic System Storage can be accessed anywhere, -Backup Data	-Can occur when visiting crowded and space is full of uncontrolled storage.	-Rejuvenation device and routines perform data backup internet bandwidth	-Server down can occur if a visit to the bustling academic system
SO	ST	WO	WT
Already using SSL in anticipation	-Using the SSL the database server, application, streaming database -Network aspect: install a firewall	-create multiple virtual storage space	using java in operation

B. Data processing

The composition of KPI was started by studying the perspective of IT BSC. The perspective was aligned with strategic goal of academic information systems so that the KPI for academic information systems is displayed in Table 4.

Table 4. Key Performance Indicator

BSC IT Perspective	Key Performance Indicator
Contributions Organization	
Achieve organizational contribution that is the business value of information technology and the effectiveness from the application information systems	Improving the effectiveness of academic administrative services
User Orientation	
Providing information systems on-demand to achieve user satisfaction	-Operator system of satisfaction -Increase the system operator competency
Operational Improvement	
Providing maximum IT products and services for effective and efficient information systems	Improving the quality of information systems
Future Orientation	
Answering the challenges of the future by educating and training the IT staff as well a research on the development of IT	Increase IT staff expertise

Then for the KPI that had been set, targets are determined specifically for each KPI. KPIs and targets were reassembled into their respective IT perspective Balanced Scorecard as shown in Table 5

KPI targets derived from the translation of each IT Balanced Scorecard perspective so that it comes into several sizes. Next step is determining the final value of the balanced scorecard prior to calculation of IT balanced score card.

Table 5. Target KPI

BSC IT Perspective	KPI	Target (%)
Contributions Organization	Improving the effectiveness of academic administrative services	80
User Orientation	-Operator system of satisfaction	75
	-increase the system operator competency	80
Operational Improvement	System Quality Improvement	78
Future Orientation	Increase IT staff expertise	75

Table 6. Value End Performance Balanced Scorecard

Value (Score)%	Scale	Category
73-85	5	Excellent
59-72	4	Best
45-58	3	Good
31-44	2	Bad
17-30	1	Very Bad

Table 7. Results of Data Processing Perspective User Orientation

Strategic Goals	Strategic size	Strategic target	Actual conditions	Achievement
Providing information systems on-demand to achieve user satisfaction	BANK Officer appearance	75%	73%	74%
	Officer control in matters	80%	68%	74%
	Speed of response officers	80%	67%	74%
	seriousness and patience officer	80%	67%	74%
	alacrity of officer	80%	68%	74%
	Officers timely solve problems.	75%	60%	68%
	The credibility of the officer.	75%	71%	73%
	Hear any complaints properly.	75%	68%	72%
	Friendly and courteous attitude of the officers.	75%	75%	75%
An understanding of the user's problem.	75%	69%	75%	
Total				731%
Average				73%

Total of 15 questionnaires were sent out, and returned as much as 15 questionnaires, a total of 15 questionnaires were answered. Table 7 s / d Table 10 is a recapitulation of the calculation data processing for each IT perspective Balanced Scorecard.

Table 8. Results of Data Processing Perspective Contributions Organization

Strategic Goals	Strategic size	Strategic target	Actual conditions	Achievement
Achieve organizational contribution that is the business value of information technology and the effectiveness from the application information systems	The procedure for applying clear	80%	72%	76%
	Supplies adequate physical	80%	75%	78%
	Services via telephone.	80%	57%	69%
	Certainty of time.	80%	57%	69%
Total				291%
Average				73%

Table 9. Results of Data Processing Perspective Operational Excellence

Strategic Goals	Strategic size	Strategic target	Actual conditions	Achievement
Providing maximum IT products and services for effective and efficient information systems	Easy operation and to facilitate student activities and lectures.	78%	83%	81%
	Easily accessible anywhere and anytime.	78%	79%	79%
	Fast access and fast download process.	78%	67%	73%
	Network is not easy down.	78%	45%	62%
	Data confidentiality secured and not easily hacked.	78%	61%	70%
Total				363%
Average				73%

Table 10. Results of Data Processing Perspective Future Orientation

Strategic Goals	Strategic size	Strategic target	Actual conditions	Achievement
Answering the challenges of the future by educating and training the IT staff as well a research on the development of IT	timely and accurate information.	75%	72%	74%
	The information is presented in accordance with the needs and activities.	75%	73%	74%
	Timely delivery of information.	75%	61%	68%
Total				216%
Average				72%

Furthermore, the weighting of the strategic objectives for each perspective of the IT Balanced Scorecard were determined. The weights are set based on observations during the study in PUSTIPANDA which was then approved by the management. Weights are determined to find the results of interest of each outcome measure. The weights are obtained under the agreement and approval of the parties. Furthermore, target fulfilment level results at each IT perspective Balanced Scorecard will be determined (Table 12) as well as the results of performance measurement of academic website.

Table 11. Results of Strategic Objectives Weighting

Perspective	Strategic Goals	Weight	Result Size	Results Goals
User Orientation	Answering the challenges of the future by educating and training the IT staff as well a research on the development of IT	50%	73%	54.75%
Contributions Organization	Providing maximum IT products and services for effective and efficient information systems	55%	73%	58.4%
Operational excellence	Achieve organizational contribution that is the business value of information technology and the effectiveness from the application information system	53%	73%	56.94%
Future Orientation	Providing information systems on-demand to achieve user satisfaction	50%	72%	54%

Table 12. Results of Measurement

Perspective	Results Goals
User Orientation	54.75%
Contributions Organization	58.4%
Operational Improvement	56.94%
Future Orientation	54%
Total	224.09%
Average	56.02%

C. Analysis of Data

The results of data processing of 15 respondents in the four perspectives of the IT balanced scored card showed that on user orientation, the contribution of organizational and operational excellence have 73% which is in the position of 'Very Good'. However to the perspective of the future orientation, the value is 72% so it is in a position "Good". In addition, when viewed from the weighting of the strategic objectives, the four perspectives has a score of 54-58% so that only occupy the position of "Good enough". The position is obtained from the value of final performance on the method of Balanced Score Card

V. CONCLUSIONS

The measurement results was obtained from the four IT balanced scored card perspectives on the AIS UIN Jakarta academic web. The perspective of User Orientation gets 54.75%, Organizational Contributions get 58.4%, Operational Perfection gets 56.94% and Future Orientation gets 54% with each category at "Good" level

The perspective results from the four perspectives of the IT Balanced Score Card for academic web in average is 56.02% where the score is at the level of "Good enough".

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