Designing Cloud Computing Architecture for Bank Industry: The Case of Dashen Bank

ABSTRACT

Technology makes life easy. People contact banks in their day to day life activity. And also the banks are committed to serve their customers with the help of currently advanced technology. The aim of a bank is to give consistent and satisfactory banking services for the customers. The use of advanced technology in banking requires sophisticated knowledge of the technology and expertise and a large number of employees are required for implementation and management of that system.

Cloud computing makes easy the management of IT infrastructure and the bank sector systems. Cloud service providers provide three basic types of services: infrastructure as a service, software as a service and platform as a service. In a cloud environment, there are concerns in the security and confidentiality of the data placed at the cloud.

The main purpose of the study is design the cloud computing architecture for Dashen bank, which will reduce the labor need for managing IT infrastructure and system and enhance the use of technology with the required security verification.

The study focused on designing aspects of cloud computing. The study used interview, observation and document analysis to gather the data. The interview was conducted on the selected department and employee of the bank. The observation was at the data center of the Dashen bank using a checklist. All the required data was collected from the head quarter of Dashen bank.

The study revealed the management of the bank recognized the potential benefit of cloud computing and has started dealing with companies like Microsoft and IBM to adopt the technology. However, because of the absence of regulatory framework and security concerns, immediate adoption of cloud computing tend to difficult.

Future researcher needs to focus on assessing and developing an appropriate security system for bank sector. In addition, appropriate policy and procedure needs to be crafted by the regulatory body like NBE and MICT

Keywords: cloud computing, SaaS, IaaS, PaaS.

1. INTRODUCTION

In the evolution of computing technology, information processing has moved from mainframes to personal computers to server-centric computing to then to the Web-based system. Cloud computing is a newly emerging and vastly growing technology. It is a computing resource deployment and procurement model that enables an organization to obtain its computing resources and applications from any location via an Internet connection (IBM, 2013).

According to Sriram (2011) the most common types of cloud computing deployment models are four (4), those are:

• Private cloud: The cloud infrastructure is operated solely for an individual organization and managed by the organization or a third party; it can exist on or off the organization's premises.

• Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has common interests (e.g., mission, industry collaboration, or compliance requirements). It might be managed by the community organizations or a third party and could exist on or off the premises.

• Public cloud: The cloud infrastructure is available to the general public or a large industry group and is owned by an organization selling cloud services.

• Hybrid cloud: The cloud infrastructure is composed of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

Each type of cloud computing deployment model will possible through either of three services models that is software as a service (SaaS), infrastructure as a service(IaaS) and platform as a service(PaaS).

Software as a service (SaaS):- in this model, the user is provided with continued access to IT applications and pays only for their actual usage. Access to these is provided like in the PaaS and SaaS models, however, unlike them, the software used is owned by the provider and it is the provider who is responsible for the updating and maintenance of the software.

Infrastructure as a service (IaaS):- this is an IT infrastructure accessed from and using the internet. Mainly IT hardware. Hardware includes, among others, a predefined virtual server or any of its components that are selected by the customer/here in the bank as necessary

2. LITERATURE REVIEW
Cloud computing provides an option for the user to use advanced technology and being beneficial to its features. The use of cloud computing that the most advanced technology in the field of IT infrastructure, is a dynamic of its own capabilities, the most common way to share and manage IT resources in developed countries world, developing its infrastructure and cloud-based services with the speed, is growing, (Niazmand, 2015). Cloud computing provides the full scalability, reliability, high performance and relatively low cost feasible solution as compared to dedicated infrastructures (Awadallah, 2016).

Cloud computing makes the business scalable and upgradeable in the bank industry. Using cloud computing banks can create a flexible and agile banking environment that can quickly respond to new business needs Cloud technology offers secure deployment options that can help banks develop new customer experiences, enable effective collaboration and improve speed to market all while increasing IT efficiency (Patani, Kadam and Jain, 2014).

Although cloud computing models are ready to assist the banking sector in numerous ways, but the banking industry has serious concerns about their sustainability. Some of their integral and prominent concerns are security, privacy, confidentiality, data integrity, and authentication requirements, along with the location of data, availability, and recoverability.(Rani and Gangal, 2012).

3. STATEMENT OF THE PROBLEM
Banks have a huge number of IT infrastructure and deploy an appropriate system that allows the banks to do their business transaction process. The type of system and technology the banks uses to make the bank being the first choice by the customer. Deployment and management of the system and IT infrastructure requires big financial fund and strong management skill. Because of cloud computing providing easy management option for the cloud customer passing out of the service through cloud provider is the best way.

Business sectors can benefited from the fact that cloud computing helps to create a more flexible, agile business model to meet the growing business needs in a dynamic and competitive landscape. Cloud computing helps banks to transform their business processes and enhance their ability to grow in new sectors or regions without the time and cost burdens involved with establishing a physical presence (Awadallah, 2016).

In any financial services institutions, IT infrastructure and support are constantly facing cost pressures, while computing needs and amount of data are ever increasing. These increasing IT usages enforce banks to invest million dollars for procuring computing resources and re-procuring when computing needs and business data are increased over time (Alemayehu, 2013). The critical thing that we need to see in infrastructure architecture is the ability to scale, the "traditional" non-cloud infrastructure, systems are typically architected to sustain potential future growth and resource demand (Gorelik, 2013).

The bank main objective is to facilitate financial business transaction based system using the advantage of existing technology. To make the business as such effective organizations need to focus on their aim without

bothering and wasting of time on information and IT infrastructure management. So cloud computing is an ideal solution to get rid of these issues.

4. METHODOLOGY

The methodology of the study is qualitative and focuses on designing cloud computing architecture for the bank industry. The design of the research follows the following steps. The data collection mechanism of the study was a literature review, observation, interview, and document analysis.

4.1 Literature Review

For the awareness and more understanding of cloud computing and the way how cloud computing will implement in a financial environment especially in the bank, the researcher reviewed the literature and other related works in cloud computing.

4.2 Observation

the researcher observe Dashen bank mainly the data center of Dashen bank located at head office to investigate the degree of how much the IT infrastructure is used, the overall working condition they deploy, the comfortably of the IT infrastructure basically the condition of the data center and security strength, this security includes the physical and logical security of data center and machinery and procedure of the data center. Although observing the type and the amount of material stored at the data center is essential because it is helpful to know the resource need of the origination and the amount of expenditure of the material to cross-check cost analysis.

4.3 Asking IT Professional of Dashen Bank [Interview]

The interview questioner developing method is based on the reference of Zachman framework and consist of this basic action question starter's i.e. what, how, where, who, when and why. According to Berg (2004) this questions will give the basic indication for the research data collection questions and can help and explore as follows

What and how: help to establish the problem and issues.

Where, who and when: this focus on the specific actors, event, and activates that relate to the problem or issue at hand.

Why: help to establish a general focus for the investigator and stockholders, reminding everyone what purpose of the study originally was.

Because of the objective of the study is to design cloud computing architecture for bank dealing with IT professional were interested. Most of the interviewee was from IT infrastructure department of dashen bank that was included from the director to supportive staff and the remaining were from other four(4) department that are directly concerned and answers with cloud computing related to the questions with the Zachman framework reference. Having the reference of Zachman framework the interview made and giving an information's in the area that will check the awareness of cloud computing on the organization including top-level management and employed staff, the plan of the organization to swipe the current service providing mechanism by cloud-based system, the extent of believing cloud computing provider and the expectation of the challenge and fear on the cloud computing based system, the section or department that need more strong security in bank system, the procedure made in Ethiopia about cloud computing, the need , opinion or request of the customer about cloud-based system ,the incompatibility issue of the infrastructure and system the company faced before, the strategy that the bank has to work on cloud computing and the fear, expectation and willing of the bank on cloud computing by cost, trusty and availability.

4.4 Document Analysis

The document analysis portion of this study data collection is analyzing and visualizing the current working instruction of the organization and how they work or the working trend of the organization. In this specific study, the document analysis part will refer the document of the Dashen bank in which the organization currently used

in cloud computing and IT related things. And also the cloud computing architecture and security framework that currently the company used have been referred. On the current study of this paper, I have gotten the essential and necessary document from a different source of the bank placed as the document. The main point of the observation was included

❖ The current IT infrastructure design of the bank

❖ The report in which is state the financial investment for IT equipment and human resource

❖ The working instruction and legality acceptance in Ethiopia

❖ Annual report, the journal of the bank to understand the financial and systematic workflow

❖ Future plan of the bank that it will expand and work on cloud-based services

5. DISCUSSION

The discussion of the collected data focuses on the interview question, observed place and reviewed documents generalized and presented as a follows,

5.1 Existence of Problem

The bank uses a different system to serve the customer, and that system also supported a number of information related to customers profile and other vital records. As the employee and management of the bank respond there are system failures at working time and loss of data occasionally. By the effort of the information system and IT department the system being recovered into the previous session and a data also recovered.

5.2 Awareness Of Cloud Computing

As cloud computing is a new discipline, investigating the awareness of the employee and higher management about cloud computing was compulsory and done. Based on the information gained from the interviewee, almost all interviewee from the IT infrastructure department are well aware of cloud computing and its basic function plus deployment model. Whereas from the remaining part of the interviewee section they did not know about cloud computing principle, usage, and related things.

5.3 Interest and Plan To Work By Cloud Based System

The bank is fully interested to work using cloud-based system. In addition to the interest, the bank also started to work with some cloud providers, for example, Microsoft. The employee and management of the bank knew about cloud computing due to this they also know the benefit and the challenge of the cloud they also list out some of them. From the benefit, the most and common are make the bank to focus on core banking activity, reduce the time taken for information management, data center and IT infrastructure management, reduce unnecessary expenditure and cost expense on-demand capacity utilization, easy disaster recovery, easy scalability and upgradeability feature of the system. The bank management and employee mentioned that security risk, reliability due to a connection problem, international and local legacy rule and regulation, no local cloud service provider in Ethiopia and consistency of internet at Ethiopia are the challenge of full deployment and implementation of cloud computing. Foremost the department or the section that require more security aspect is core banking and E-banking.

5.4 Trust of The Service Provider

Customers do not directly engage with the new services offers unless they know the benefit or crisis of the system. Cloud computing was not implemented in Ethiopia, this makes the customer of the bank have a negative image on their system. Because of the employee and management bank knows the benefit and risk cloud system, the bank trust the word class cloud services providers like Microsoft, IBM, and Oracle.

5.5 Local and International Rule and Regulation

Internationally there are a number of cloud computing users and providers. In Ethiopia, there is no well-written rule and regulation for cloud computing users and providers. As the IT infrastructure director of the bank

spoke there is some initiation to develop rule and regulation of cloud computing by MICT. Even For the full implementation of the cloud, the NBE did not have any rule to permit any bank for the usage of cloud computing since every bank in Ethiopia is governed by NBE.

5.6 Financial Expenditure and Resource Usage

In order to know the benefit of cloud computing in the sake of financial investment observation the data center and some infrastructure and document analysis was necessary because of these observed and document seen. The observation mainly focuses on the amount and type of devices that the bank uses and the safety of the data center for consistency of the service.

6. RESULT

As a result of collected and analyzed data, the researcher concludes that as into two ways. One in wish and interest with reason and tackle and fear for do not deploy cloud at a bank.

6.1 Interest and Wish Of The Bank

Dashen bank is one the private and one step forwarded in technological implementation. Due to this the top level management especially working at IT-related staffs the bank is ready, interested even they started to deploy and work by cloud-based system. They have also put as a reason why the bank choose cloud system and what benefit will the bank gets

1. Since the core and basic aim of the bank is to process a business transaction so the bank needs to leave the information managing process for the third party. Information management takes a number of human and financial resources.

2. The bank is benefit-oriented but to full fill, the data center and other infrastructure the bank cost a huge amount of money this also another risk even if the bank will cost for the service provider.

6.2 Tackle and Fear of Cloud

Even cloud have the benefit for the organization it has also a drawback for it. According to the interviewee, the major frightens for the cloud is

1. Security: the bank data is very sensitive and need strong care but cloud computing will implement via the internet and the internet-based system is near for hacker and cracker so this one will as the drawback of cloud computing.

2. Customer perception and trust: because of the service is not as such familiar for Ethiopian people the customer will not have trust in the system and the bank too

3. Procedure: in Ethiopian no ground rule that governs cloud and even there is some negativity for not outsourcing bank data for international origination.

4. Internet: since Ethiopia has only internet service provider there is internet connection interruption.

7. The design of the proposed PROPOSING CLOUD ARCHITECTURE
architecture consists of the layer which indicated in figure 1 with the detail component of each layer and the description for each attribute.
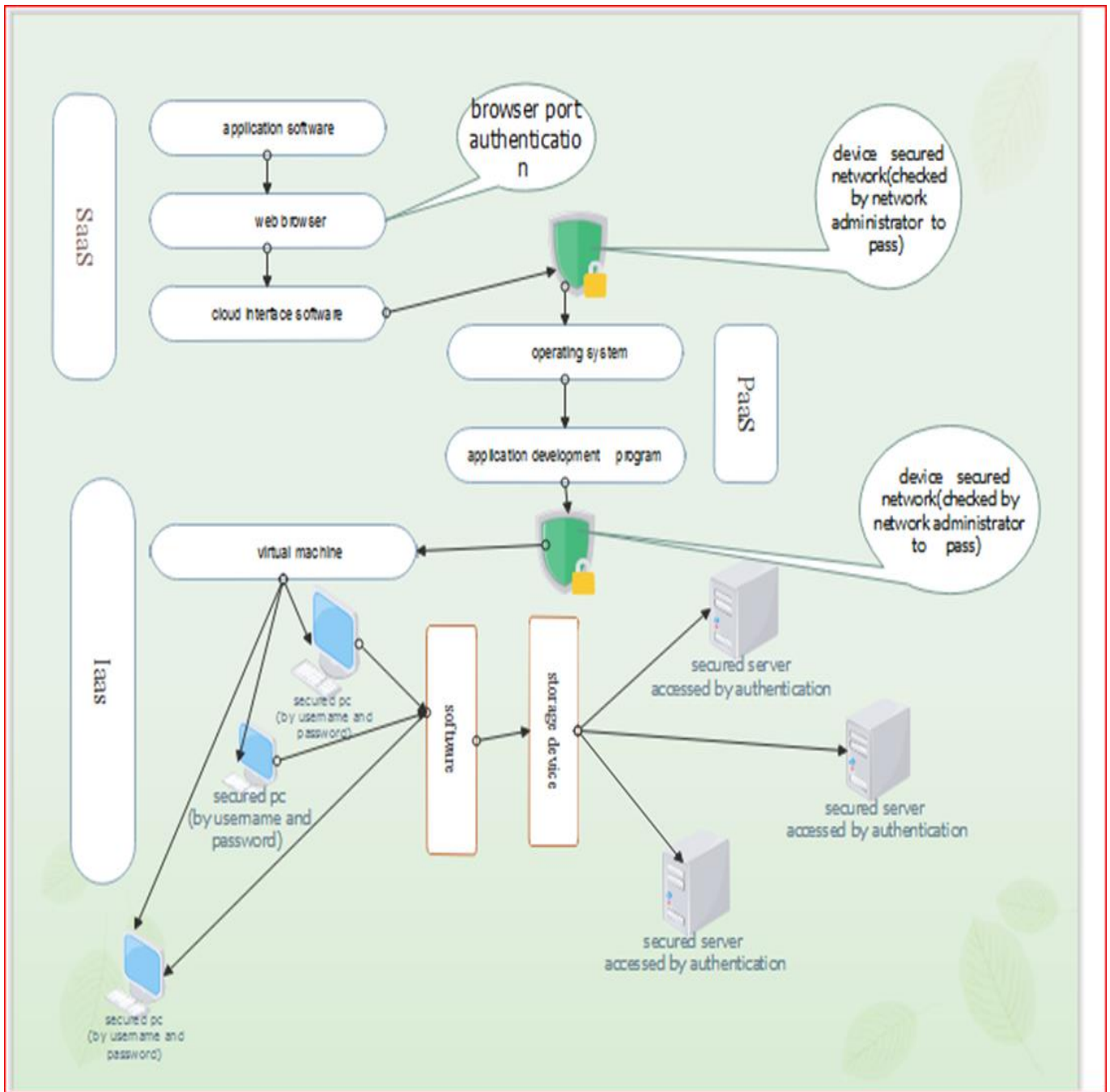
Fig 1 proposed cloud computing architecture

7.1 SaaS Layer

The software as a service layer of this architecture contains the software package that allow to implement the cloud at the bank (cloud interface) plus the software that Dashen bank use to make transaction, process an activity that will use for decision making and compatible and authorized   browser that added on the directory of the bank for the use of security. This browser also displays the image (any request) after it made fitter.

7.2 Management Layer

The layer in which that manage the activity between the cloud provider and the user of it(Dashen bank) include service request, software usage approval and authentication, privilege deliverance and like of functions. On the figure, the two sub-layers are the part of this layer i.e. operating system and application programming development.

7.3 Data Security and Privacy Layer

The major challenge of the cloud computing system is the security system, in this proposed architecture the security layer has a step to identify the authorized user on not at the provider end using browser authentication and at the bank end using username and password to access the client computer. The Dashen bank security team first authenticate and authorized the Dashen bank employee to connect and access the database and the full system.

7.4 Functionality Layer

Functionality layer is the overall integration of the cloud system and the actual implementation of the cloud system at Dashen bank, including accessing of the system and device, controlling and monitoring of the system and device, transaction and information processing of the bank.

8. CONCLUSION

The research paper focused on designing cloud computing architecture for the bank industry in particular for Dash bank operated at Ethiopia. While designing the main issue to be addressed is to make the system more secure from third party intruder. This helps the customer on the bank to develop confidence in their transaction and avoid the fear of potential information loss.

Cloud computing has an advantage for the cloud customer by making the management of IT infrastructure and system easy, saving of time and money and familiarize the customer with updated technology. Bank sector need to focus on the business and transaction process with the help of the current technology, the technology deployment requires much amount of money and human labor. Cloud computing is the ideal point to facilitate the bank financial transaction process and develop the bank by managing and deploying of the IT infrastructure and system.

Like that of the advantage, the cloud computing has risk related with security means that the customer of the cloud's computing did not really trust on their data confidentially and none accessibility of the system by the third party; this leads the customer did not trust the bank.

9. RECOMMENDATIONS

The designed architecture for Dashen bank is a logical design that will show to the bank there is another way to make the business possible in an easy manner with better efficiency. As one barrier to doing not fully deploy cloud at the bank is no local service provider in Ethiopia.

 Cloud computing service can be delivered in a three-way in each of the service models each of the service can accessible throughout the internet, internet uses shared line for the service availability this leads for access by the other. Accessed by other rise security issue, since finical information is critical if so security strength is compulsory for cloud computing at the bank. The researcher needs to make more focus on security framework. In general, as the discipline is new and further research on shared cloud environment is needed.

The service delivered by a cloud service provider can acessable anywhere since it is the part of the network. Managing and being responsible for the misuse of any data is ambiguity, the fault may be from the cloud service

customer or the provider. I recommended for the future researcher to do their research work on access control mechanism of cloud computing.

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