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Toward a model for cloud computing banking in Yemen

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Abstract
Cloud computing is one of nowadays technology trends which provides a new way to manage the different information systems, such as banking systems. The transactions between the banks' accounts must be managed with a high-level security and a high-level performance with a real-time system management if the system needs for an emergent system recovery. All of these features can be provided easily and on-demand using the cloud computing. In addition, like any other telecommunication technologies, it needs some specific components which must be connected in a standardized manner to achieve the best results. Yemeni banks have parts of this needed infrastructures. However, they hadn't started their own cloud computing banking yet due to the fear of losing the high security offered by the local networks providers. In this research, we are going to highlight a roadmap of developing a model for cloud computing banking in Yemen. This will contribute in upgrading the technologies used in the managements of the information systems of banks in Yemen.

Keywords: cloud computing, banking management, on-demand services, scalable infrastructure, cloud computing banking, yemeni banks

1. Introduction

Cloud computing today encompasses every vertical in the market across sectors. Organizations are adopting innovative cloud apps to support their everyday business operations. 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. Banks that take advantage of cloud computing are better positioned to respond to economic uncertainties, interconnected global financial systems and demanding customers [1]. Before moving to the cloud, banks must consider issues around data confidentiality, security, regulatory compliance, interoperability of standards, and quality of services [2]. The banks in Yemen tried to solve these issues using the traditional networks depending on the internet providers and some data center infrastructures. Cloud adoption can improve banking speed of performance, cost avoidance, simplification of the service catalogue and revenue growth. Cloud adoption also add benefits like: respond to growing competition, expand the bank's brand, and avoid risks and manage security [3].

There are many researches which study the banking as an online banking, electronic banking, mobile banking and the internet banking. Those pieces of research study all those fields from different perspectives. The cloud computing banking is a new technology which benefits the internet technology and many other technologies to provide the security, ease of use, availability and scalability. This new technology achieved various successes especially with the systems which need to have high availability. Some of Yemeni banks started in the last few years offering some infrastructures those can be used to create a cloud computing system. However, no one of those banks had used the cloud computing yet. Moreover, the boards of Yemeni banks don't trust in cloud computing as a secure technology, although they can have their own cloud computing systems.

There're some reasons to have a cloud computing banking [4-7]:

- **Performance:** using the HPC and the HTC, cloud computing performance is better than the performance of any other communication technology. Traditional network performance can provide a very little increase of the performance.
- **Availability**: the cloud computing services is available anytime everywhere. Most of traditional management systems in Yemeni banks are available in the working hours only.
- **Security:** The local networks are safer than the wide-range networks in general. But according to the solutions provided by many researchers and security companies, cloud computing can provide various solutions for this matter. There are two main cloud computing models (public and private cloud computing). The private cloud computing is more secure than the public cloud and therefore it will be a good choice for the banking systems.
- **Energy efficiency:** Cloud computing can save power more efficiently than any other communication technology. This is due to the developed algorithms and researches in greening and enhancing the cloud computing.
- **On-demand self-service:** provided by cloud computing providers to enable the cloud resources provisioning on demand whenever they are required. In on-demand self-service, the user accesses cloud services through an online control panel. The traditional system

management can't do all of that physically or with the same quality of services. On the other hand, traditional systems need to pay everything it needs, where the cloud computing resources can be just rented.

- **Broad network access:** which are the resources hosted in a private cloud network (operated within a company's firewall) that are available for access from a wide range of devices, such as tablets, PCs, Macs, and smartphones. These resources are also accessible from a wide range of locations that offer online access. The traditional systems can use these resources, but of the range of accessed devices is very little, then the resources may not work in the same efficient way.
- **Resource pooling:** describe a situation in which providers serve multiple clients, customers or "tenants" with provisional and scalable services. These services can be adjusted to suit each client's needs without any changes being apparent to the client or end user. This feature can't be provided by a very limited number of resources hosted in the same geographical place.
- **Rapid elasticity:** ability to provide scalable services. Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time. Scaling the resources is limited to be offered using the limited resources of the traditional systems. The resources, used in the banking management systems by many banks in Yemen, are less than needed especially when there is a work load.
- **Measured Service:** Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for the provider and consumer. This feature is not provided by any banking system in Yemen till this moment.

According to the all above, we are going to develop a new model that will try to provide all these features as possible in the cloud computing banking to be adopted as the new technology to use and to provide the banking services in Yemen. The rest of this research contains related works of the cloud computing banking, the proposed model for the cloud computing banking, the discussion of that model, and finally the conclusion.

2. Related work

According to Jiang, *et al*. [8], "Cloud computing is an Internet-based application platform, which provides enterprises with shared resources including hardware, software, data storage, and customizable business applications on demand." Cloud computing is a result of four technologies convergence: Hardware Technology, Internet Technology, Distributed Computing Technology and the System Management. Cloud computing enhances business functions for everything from advanced data analytics to compliance activities and HR [9]. Nowadays it covers various fields of our daily lives, especially in commercial side. The most important part of commercial processes is the money exchanging which at the end will depend on accounts in Banks for the both sides of the exchanging transaction.

Cloud computing today encompasses every vertical in the market across sectors. Organizations are adopting innovative cloud apps to support their everyday business operations. 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. Banks that take advantage of cloud computing are better positioned to respond to economic uncertainties, interconnected global financial systems and demanding customers [1]. Before moving to the cloud, banks must consider issues around data confidentiality, security, regulatory compliance, interoperability of standards, and quality of services [2]. The banks in Yemen tried to solve these issues using the traditional networks depending on the internet providers and some data center infrastructures. Cloud adoption can improve banking speed of performance, cost avoidance, simplification of the service catalogue and revenue growth. Cloud adoption also add benefits like: respond to growing competition, expand the bank's brand, and avoid risks and manage security [3]. In Capgemini perspective [10], when a bank moves into cloud computing, there are two primary challenges that must be addressed: The first is the security. The confidentiality and security of financial and personal data and mission-critical applications is paramount. Banks cannot afford the risk of a security breach. The second is the regulatory and compliance. Many banking regulators require that financial data for banking customers stay in their home country. Certain compliance regulations require that data not be intermixed with other data, such as on shared servers or databases. As a result, banks must have a clear understanding of where their data resides in the cloud. Financial institutions must select the right service, deployment, and operating models to address security and compliance concerns. In the initial phases of cloud computing adoption, it is expected that banks will own and operate the cloud themselves with service providers taking increasing ownership and control of the cloud infrastructure as cloud computing matures and more rigorous controls become available [10].

According to Mbelli, at al. [11], management of big data becomes more important as cyber banking is becoming more evolved and becoming more and more digital. The storage of this big data will rely on technologies such as cloud. The issues of the security of these cloud technologies may include things like the vendor lock-in threats, what level of security to apply, business continuity if there is a breach of the cloud security, etc. The top vulnerabilities to South African cyber banking are [11]:

- Less or inadequate maintenance, checking and analyzing of the security incidents audit logs.
- Inadequate or insufficient security applied at application software level.
- Less control of admin privileges.
- Less monitoring and control of access to cyber systems.
- Insufficient or Inadequate incident response capabilities.
- Inadequate or insufficient security assessment and awareness.
- Poor or no policy and standard management in place.

Sahil stated that, Banks may have various reasons for

migrating to the cloud, but the main reason applications. A pivotal stumbling block for huge investments in new technologies has always been the capital expenditure needed for advance infrastructure. With cloud computing, various financial institutions only have to budget for functional expenses and wage for the services they use. This makes it effortless and more cost effective to test new applications on the cloud versus prevailing conventional infrastructures [1]. The matter is that not all the banks converted to the cloud computing. In addition, there are very few countries at the whole world that they started adoption the cloud computing. Ghule, *et al*. [12] stated that, Cloud computing can help financial institutions improve performance in a number of ways: Cost Savings and Usage-based Billing, Business Continuity, Business Agility and Focus, and Green IT. Goel stated that The majority of today's cloud computing infrastructure consists of time-tested and highly reliable services built on servers with varying levels of virtualized technologies, which are delivered via large data centers operating under service-level agreements (SLAs) that require 99.99% or better uptime. Commercial offerings have evolved to meet the quality-of-service requirements of customers and typically offer such service-level agreements to their customers. From users', i.e., bank's perspective, the cloud appears as a single point of access for all their computing needs. Regardless of the geographic location these cloud-based services are accessible as long as an Internet connection is available. Open standards and open-source software have also been significant factors in the growth of cloud computing

3. Cloud computing in banking systems

According to Al-Ariqi [20], there are two types of commercial local banks in Yemen, private and state banks. Those banks are found in the main cities only, i.e. Sana'a, Aden and the capital cities of each other governorate. The foreign banks hasn't the same problems of the local ones because the used techniques for management are absolutely different. Both of the local and foreign banks have many branches in different places in Yemen [20]. Those branches must be connected via a network. According to our interview, with one of the network experts who build and configure the banks infrastructure in Sana'a, the local banks use traditional networks. They are really have data centers, firewalls and online and offline servers. All of these equipment are installed randomly and don't follow any standards of data center or server installation. The networks' providers are local providers. The firewall is at most a hardware set and in rare they use a software firewall. The servers are also installed locally and the banks' databases are not connected to the internet. When we ask about the reason, the answer was that they can't trust in the security of the internet connection.

Although the banks systems are highly diffused in many different places in Yemen, the manual trading is the main and sometimes the only way for the money exchange. This means deficiencies in the basis of the work of the Yemeni banking sector. In addition, the performance of the operating banks in Yemen degrades day per day. The ATM is not provided by many Yemeni banks [20]. The banks those provided ATM in past, nowadays stop their ATM.

The internet banking is not a used service in any Yemeni local bank according to our study in the last month. Those banks websites are just for ads and their contents aren't changed. Some of the foreign banks provide this service. The cloud computing banking is not provided yet in any bank, both local and foreign ones. The local banks in Yemen has a weak competitiveness in the face of the regional and international foreign banks [20].

Yemeni government sector systems have no trust in internet technology. This is due to some problems can be summarized in the following

- The e-government is just a proposal and Yemeni government has no infrastructure to manage the electronic transactions.
- Piracy, sabotage and sometimes destruction of the international networks makes the government reluctant to launch the e-government.
- Some people can't trust in others.
- Some ones in banks' boards can't believe that the technology can do everything effortless. Some others love destruction of the success projects even though those projects will meet the market needs.
- The Administrative corruption.

According to all above, we aim to develop a model for the cloud computing banking in Yemen. This model must ensure high security to be adopted by the banks' boards. In addition, the model will enhance the banking services to be available anytime, everywhere and for any user. We propose this model will provide the banking services whatever the load-balancing rate is. This will be helpful in the times of payment of salaries, distribution of quotas of stock gains and so on. Using the security provided by the private clouds to make the banks' board trust the cloud computing. The result of their trust may lead to adopt the proposed model in banking. We aim also to provide the banking management services on-demand. This can be provided according to the service level agreement between the providers and the banks' boards.

We aim to develop a model for the cloud computing banking in Yemen. First, we will study the impact factors of banking usage and the real demands in the management of banks. Then will suggest the type of the cloud (public, private, or hybrid) and we will specify the needed equipment and standards according to each type of these types. After that we will suggest the needed standards and circumstances to adopt the resulted model in order to have a cloud computing banking management system. The final step will be to develop a sample example for the model and to test it to prove that it is applicable.

Statistically, we will make some questionnaire which will target the clients, employees and the banks' managements. We will visit the banks to have a real observation every time we can have the allowance from the management. Then empirically we will develop the new cloud computing banking model and will test it with a sample dataset with the agreement of one or two banks in Sana'a and Aden. The final results after that can be generalized for the all other banks in the different provinces.

4. The proposed Model

We proposes the model shown in figure 1. This model consists of the three levels of the cloud computing architecture, IaaS, PaaS, and SaaS. The banking system components are distributed among these three to gain the essential features of the cloud computing. The model

suggests a small private internal cloud for the bank. Then the management has the choice, either to use the public or the private cloud computing. The private cloud will be based on a public infrastructure to enable the cloud providing its features. The PaaS and SaaS must be owned by the bank management and we recommend the VM and its VMM too. In the public cloud, if the bank privacy and policy standards allow, the IaaS, PaaS and SaaS can be all public. The small private internal cloud must ensure the synchronization of data between the internal database and the cloud database. Some secure tunnels can be provided to ensure security.

5. Discussion

As we mentioned above, there will be two suggestions for the cloud computing banking, either to be fully public with a small private internal cloud, or to be fully private with a small private internal cloud except the IaaS layer. The first suggested to provide better performance and more high level cloud computing features. But it may be less secured than the private one. It is cost for implementation will be less than the private one because all the layers and their services can be rented. On the other hand, to save the security the model must be chosen to be private. The private cloud will be in two places. The internal cloud will be in the local in the bank and its branches. All the needed resources must be bought previously by the bank's board. The global cloud will depend on a public infrastructure to provide the hardware management and scalability. There must be some VMs to be easy to manage, easy for data migration and to provide security for the data on the public infrastructure. The platform can be rented or bought. The SaaS must be owned by the bank's board to ensure a high system and data security.

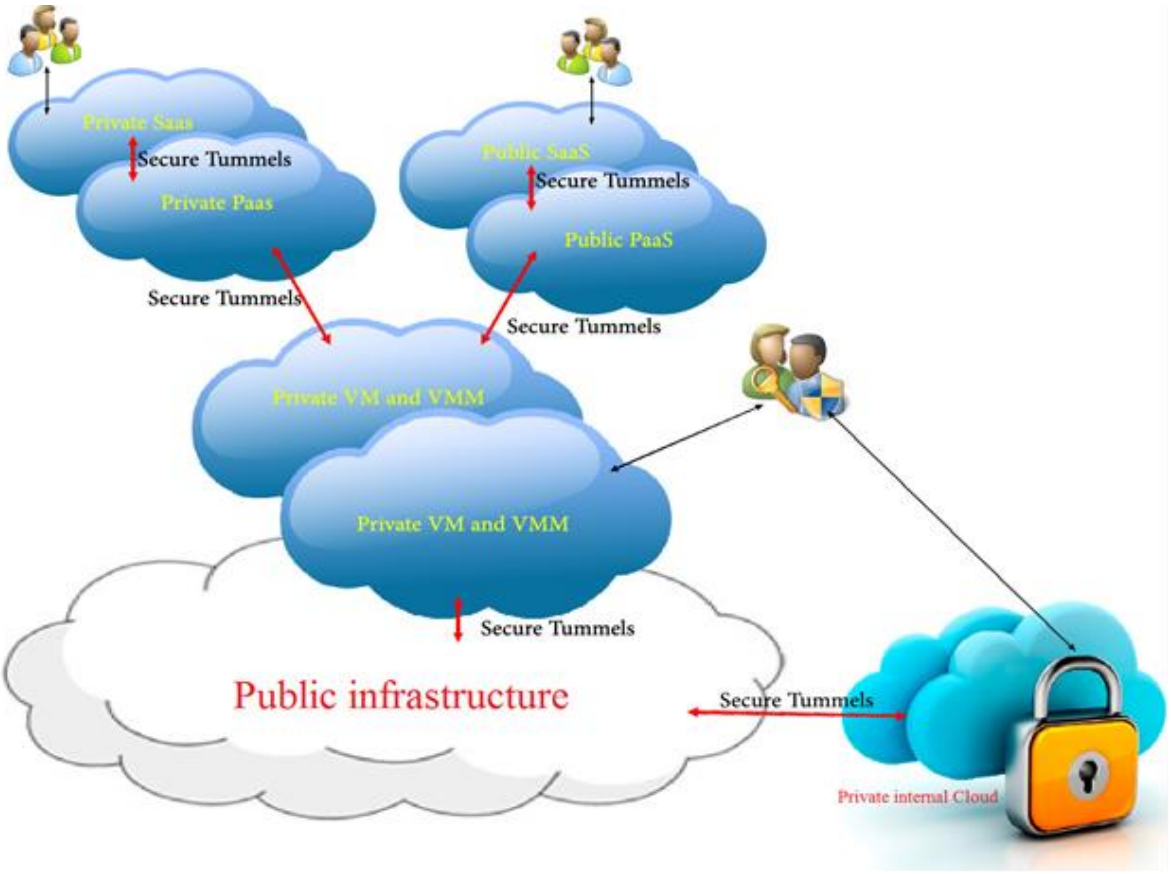

Fig 1: The proposed model

6. Conclusion

This paper was written to propose a model for the cloud computing banking in Yemen. This model can be used to manage and to provide the banking services using the cloud computing. We assume that can be adopted by any other banks is in the same environment or in any other environment that has the same features. As a future work, this model must be tested, extended and enhanced.

7. References

1. Patani S, Kadam S, Jain PV. Cloud computing in the Banking sector: A survey. International Journal of Advanced Research in Computer and Communication Engineering. 2014; 3(2):5640-5643.
2. Gupta P, Seetharaman A, Raj JR. The usage and adoption of cloud computing by small and medium businesses. International Journal of Information Management. 2013; 33(5):861-874.
3. Adelola AA. New Media and the marketing strategies of Nigerian banks.
4. Nedelcu B, *et al*. Cloud Computing and its Challenges and Benefits in the Bank System, Database Systems Journal, 2015, 4(1).
5. Chandrasekaran K. Essentials of cloud computing. CRC Press, 2014.
6. Dillon T, Wu C, Chang E. Cloud computing: issues and challenges. 24th IEEE international conference on advanced information networking and applications, IEEE, 2010, 27-33.
7. Hwang K, Dongarra J, Fox GC. Distributed and cloud

computing: from parallel processing to the internet of things. Morgan Kaufmann, 2013.
8. Jlelaty M, Monzer Y. Factors in cloud computing adoption, 2012.
9. Buyya R, Broberg J, Goscinski AM. Cloud computing: Principles and paradigms". (Eds.). John Wiley & Sons, 2010, 87.
10. Sriram S. Cloud Computing in Banking: What banks need to know when considering a move to the cloud, 2011.
11. Mbelli TM, Dwolatzky B. Cyber Security, a Threat to Cyber Banking in South Africa: An Approach to Network and Application Security. Cyber Security and Cloud Computing (CSCloud), IEEE 3rd International Conference, IEEE, 2016, 1-6.
12. Ghule S, Chikhale R, Parmar K. Cloud Computing in Banking Services. International Journal of Science and Research Publications. 2014; 46:1-2.