Cloud Computing Technology in Banking

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Abstract: - Cloud computing is experiencing a continuous growth over the past years, in both personal and business usage. Banks have been sceptical towards this type of computing, mainly because of some security issues and possible system uptime failures. That is why it is necessary to evaluate the cloud model as a possible new way of computing in banking sector. This paper evaluates the pros and cons of the cloud and tries to provide an answer to the question whether banks will embrace cloud in the future.

Key-Words: - Cloud computing, banking, data storage, security, data privacy.

1 Introduction
Recent years have shown us that cloud is an important emerging tool for almost every aspect of our personal and business lives. Every day more and more people use cloud based e-mail services, document storage, calendars and notes, maybe not even knowing that their data is saved in the cloud.

Businesses have started to appreciate cloud solutions upon realizing lower costs of building and especially maintaining applications used throughout their everyday tasks. But banks have always been reserved to this type of computing. Primarily, they said, it was because most cloud solutions could not fulfil the uptime requirements for their most important services. But the real issue was always the security of data. Nowadays, when there are multiple cloud variations and implementations, can the banking sector migrate some or all of their IT to the cloud?

2 Cloud Computing
Cloud is a type of computing which allows multiple computers to connect to a server and run applications and services using server’s resources. It is a modern type of distributed computing.

The biggest benefit of cloud computing is scalability. This means a company using external cloud can add and remove resources to and from their system according to their needs. From a cloud service provider’s perspective, this means his resources can be reallocated to multiple users in different times.

For example, if one company uses cloud’s resources as their transaction processing system during daytime, the other company can use it for their data analysis overnight.

Applications in the cloud can be accessed via web browser, thin clients or mobile devices because the data (software, platform and infrastructure) is stored on hardware at a remote location.

Cloud can be divided to a number of multiple levels, depending on the level of service [8]:
- BPaaS (Business Process-as-a-Service)
- SaaS (Software-as-a-Service)
- PaaS (Platform-as-a-Service)
- IaaS (Infrastructure-as-a-Service)

2.1 Business Process-as-a-Service
BPaaS offers support for some traditional business processes like billing, payroll calculation or human resource management (HRM). It is usually used when one of those processes is not a part of a company’s core business and they don’t have either infrastructure or the resources to buy or build their own solution.

2.2 Software-as-a-Service
SaaS is a typical cloud service many personal users aren’t even aware it exists. It offers e-mail, communication and gaming services and is often free-to-use or charged on a pay-per-use basis. Business users can find the accounting, customer relationship management (CRM) or HRM solutions particularly useful in the SaaS arrangement. Cloud
users connect to the service and use it without any need of maintaining infrastructure.

### 2.3 Platform-as-a-Service

**PaaS** includes an operating system of some sort and a number of other services (mostly for developers), like database, web server or programming language environment. Users usually cannot change the cloud structure but they do have some control over application development. This model reduces IT costs and minimizes the need for hardware and software.

### 2.4 Infrastructure-as-a-Service

**IaaS** offers physical or virtual machines, storage capacity and networks to its user and leaves the user to put his own software on the provided machines. The user has no control over the cloud infrastructure but has a full control over operating systems, data storage and other resources. This model is usually described as a fully outsourced model of IT resources.

All those levels of service offered by the cloud constitute what we call ‘as-a-service’ model of contemporary computing. Benefits of this model deployment are shown in Fig. 1.

![Benefits of using “as-a-service” IT model](image)

#### Fig. 1 – Benefits of using “as-a-service” IT model

### 3 Deployment Options

There are a few cloud deployment options separated mostly by cloud ownership and data security.

The first deployment option is a **private cloud**. This model is used when a single organization manages its own cloud for optimizing resource usage [5].

For example, if a bank would implement private cloud they could use its resources by day to run the transaction processing system and by night to run credit scoring or CRM analytics. Private cloud requires almost as much IT knowledge and resources as a conventional system with a hint of saving some hardware, software and human resources. Generally speaking, it is the most secure type of cloud computing.

**Public cloud** is open for public use. Service provider owns the cloud infrastructure and users access it over the Internet. Therefore it is not as secure as the private cloud because applications and data from multiple users are stored on the same servers and accessed through arguably secure connections [5].

**Community cloud** can be used when a number of different organizations with similar core businesses, projects or demands share the infrastructure (software, hardware or both) in order to lower running costs of IT. Community cloud can be built and managed either by joined organization or cloud service provider [11].

**Hybrid cloud** consists of two or more previously mentioned cloud deployment models. The most common combination is connecting private to a public cloud [5]. Hybrid model offers the possibility of extending some resources when a user needs them. For example, if a bank has its data in a private cloud, it could use community cloud to run data analysis when monthly statements for their clients are being generated.

### 4 Future Predictions

Many banks have a problem with utilization of their software and hardware. Their computers (both servers and workstations) are not being used efficiently and this provides some sort of a wasted capital for them. That is why some banks are already testing cloud solutions as a way of reducing IT costs [3].

One of the Big Four audit firms recently announced that banks will invest nearly 4 times the figure in cloud computing during 2014, comparing to the year before [4].

A recent *Gartner* report (from October 15, 2013) states that most industries are facing accelerating pressure for fundamental transformation in 2014 and years beyond. It also indicates that more than 60% of banks worldwide will probably process majority of their transactions in the cloud by 2016 [1].

This will cause a great deal of business process transformations for the banks. As mentioned by the Jonathan Davies, head of outsourcing at Fidelity National Information Services (FIS), the world of banking is changing and there is an increasing demand for outsourcing and SaaS offerings because mid-tier banks find it difficult to keep their legacy systems up-to-date with high market demands [2].
During these critical financial times it has become obvious that banks will have to reinvent some of their processes in order to achieve sustainability and continue the expansion and growth they had a couple of years ago. Some of the steps they will need to take are transformation of their product offerings and reorganizing their core operations to a more customer-centric one. One important segment they will have to be aware of is the rising market of online payment processors like PayPal and Google Wallet as well as mobile payment systems like the Near-field communication (NFC) [5].

In order to reorganize their processes they will have to start integrating existing systems to analyze data more quickly and accurately. Credit scoring and CRM solutions will have to take more responsibility in predicting future trends and not just analyzing past ones.

5 Potential Challenges

Although big financial, technology and manpower savings sound great to banks, there are still a number of issues to be resolved. Some of them may be:

- Regulatory requirements
- Data privacy
- Data location

5.1 Regulatory Requirements

The first potential challenge is the need to modify regulatory requirements in some countries in order to allow confidential data to be stored in the cloud [8].

In July 2013, the Netherlands banking regulator approved one of the top cloud provider’s solutions to be used by financial organizations. It was joined by Spain, Italy and Australia whose banks already use cloud [6]. This is a big step because it shows that service providers are really trying to bring cloud closer to the financial sector and are constantly working on data security.

5.2 Data Privacy

Maybe the most important issue when considering a cloud solution is the data privacy [8]. Every organization is bound to store their data securely and use it only in its regular business routines. Therefore it is necessary to strongly evaluate provider’s security policy and trustworthiness before sending data to his infrastructure, either for processing or storing it.

Consequences of a malicious contract can have a great effect on company’s trustworthiness in the eyes of its clients, even to the extent of total bust.

5.3 Data Location

Data location can also create many challenges if it is not clear where the data is being held. The data is usually protected by the laws of a country where the servers are located and levels of legal protection can incriminate security.

Some cloud providers claim that data is stored in their datacenters but it is actually stored at third-party’s datacenter. Also, there are countries who define that all data stored on their territory can be accessed by the government agencies.

6 Banking in Croatia

Croatian banking sector consists out of 31 banks with 21.6 thousand employees in total. They are mostly held privately with 5.2% in domestic private property, 90.0% held by foreign private investors and a mere of 4.8% of the banks are in government property. More than a third of them, mostly small banks, have sustained financial losses during 2012. Total capital of the Croatian banking sector was just over $70bn at the end of 2012, with a 5% rise from 2009 [12].

Banks in Croatia are not familiar with taking much risk on the financial markets. That is the main reason for quite steady banking sector which hasn’t suffered much during the financial crisis whose consequences can still be seen in Croatian economy. The only major problem all banks share is a substantial number of foreign currency loans in Swiss Francs (CHF) since the Franc started to appreciate unexpectedly in 2011. This problem hit most of the world’s financial markets as well as Croatian [12].

All banks have their own IT sectors with a number of tasks outsourced to more skilled service providers. Some of the services maintained by outside experts may include e-mail server administration, system or network administration, IT helpdesk or the deployment of new system components (like servers, database instances or BI portals).

From the customer’s point of view, Croatian banks offer as much of the banking services as banks all over the world, in both financial and technical aspect. A customer can find many types of
current accounts and associated services, all of the worldwide accepted credit and debit cards, a broad perspective of loans and savings accounts, as well as highly secured online and mobile banking solutions.

In spite of that, a most recent market analysis showed that only 27% of Croatian citizens use online banking services and a mere 5% use mobile banking. When we compare these results with data from neighboring countries, it is obvious that there is a lot to be done in popularization of these services because the regional leaders Czech Republic and Slovakia have a 64% and 63% (respectively) of online banking users [13]. A more detailed structure of online banking users in particular countries is shown in Table 1.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>ONLINE BANKING USERS</th>
</tr>
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<tbody>
<tr>
<td>Czech Republic</td>
<td>64%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>63%</td>
</tr>
<tr>
<td>Austria</td>
<td>47%</td>
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<tr>
<td>Hungary</td>
<td>41%</td>
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<tr>
<td>Croatia</td>
<td>27%</td>
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<tr>
<td>Romania</td>
<td>25%</td>
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<tr>
<td>Serbia</td>
<td>14%</td>
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Table 1. Online banking users in selected countries

It is reasonable to assume that Croatian banks would consider moving some of their processes to the cloud in order of gaining some financial and organization benefits. They mostly have the necessary infrastructure and manpower to start building private cloud solutions. It remains to be seen when this type of computing will be embraced at to what extent.

7 Experiences Gained so Far

A bank in India was experiencing a 30% quarter-over-quarter growth for 52 quarters and wanted to remain competitive on a highly growing market of retail banking. In 2011, they analyzed the existing system and decided that a cloud-enabled database would help them achieve the desired goal. Their private cloud database is implemented so it can create a new database based on the current-one’s information. The system creates a new database in the background from the last existing backup. Also, new system allows them to restore the database in just three and a half hours instead of three days, the time that was needed in the old system [9].

One of the largest banks in Australia started their cloud project when they realized that existing systems will not be able to keep up with regular business processes. Their initial expectations are shown in Fig 2.

![Fig. 2 – System resource usage-prediction before and after cloud implementation](image)

So they built a shared infrastructure and software platform, implemented over 300 small and medium database environments to 3 computer grids and applied a sophisticated disaster-recovery system. The grid itself can provide CPU power to any system that needs it. Because of all that, their server utilization grew from 15% to over 80% which means that financial cost of hardware and licenses has significantly dropped [10].

Their experience has provided a graphical representation of financial saving after the implementation of cloud (Fig. 3). It is obvious that cloud requires higher initial investment in order to gain the desired functionality but the claim is that a break-even point can be achieved within one financial year after the initial investment. It is also highly recommendable to move as much existing applications as possible to the cloud [10].

Smaller number of servers has a positive impact on energy consumption so the company is now kinder to the environment than before.

8 Feasible Steps in the Future

The first cloud implementations of cloud in the banking segment are usually for some non-core business processes like HR or CRM. The experience
banks have derived from those “test-systems” is the one that helps them decide how fast they will move to the cloud. This helps us predict some future trends in cloud deployment for the banks.

![Graph showing traditional silo approach vs grid computing model](image)

**Fig. 3 – Financial savings experienced by implementing a cloud solution at an Australian bank**

Because of data security and potential untrustworthiness for the offered, public cloud is a great way of testing the initial systems. Banks can implement private cloud in their existing IT systems using their own technology and human resources with a possible help from some outsourced cloud consultants. When they determine the benefits of using a cloud solution, they will probably decide to extend the list of functions and processes being operated from the cloud.

At this point they could start using or building a community cloud or extend a private one. If they choose the private option, it will be necessary to run two parallel systems for some time until the cloud confirms its advantages. As they move more operations to the cloud their existing equipment will be transferred to help new model.

This is the point where cloud starts to pay off because scalability comes in perspective. For instance, let’s assume that data warehousing (DWH) and business intelligence (BI) departments each had a server to run their processes on. DWH mainly uses its server during the night to transfer data from a transaction processing system to a data warehouse and the BI department uses theirs during daytime to run analytics and generate reports. When the cloud is implemented they could use the processor power of only one server.

If there is a need for more processor power at some time (e.g. regular monthly reporting which lasts for a few days every month) the extra power will be used from the cloud’s resources because some other system might have lower activity during those days.

After some time, when the private cloud is fully implemented for the designated processes, we might even see moving some of the processes to the hybrid or community cloud.

![Diagram comparing typical legacy infrastructure and cloud computing](image)

**Fig. 4 – Data structure comparison in a legacy and cloud infrastructure model**

Let us assume that the CRM cloud solution was implemented in a bank’s private cloud. Since CRM framework can take a lot of storage space and requires regular maintenance (not to mention the development of new prediction models) it might be beneficial to move the CRM to a hybrid or public cloud.

A hybrid cloud provided by the CRM system provider would guarantee a higher maintenance level and the usage of new prediction models as soon as the CRM developers create them. This will ensure that the bank’s competitors do not have the advantage if their solution is already in the provider’s hybrid or community cloud.

![Table showing usual IT processes in banks](image)

**Fig. 5 – Usual IT processes in banks (grey-ones are not likely to be moved to cloud)**
At last, we will examine the possibility of using a public cloud for the banks. Since there will always be some question about data security, it is hard to predict whether core systems will ever move to the public cloud. But some non-core processes might.

First of them is the monthly statement delivery. Bank could deliver it directly to client’s cloud-based email or a storage drive. There could also be an option of a one-click payment for your credit card invoice if you use online banking. Then the data from your digital invoice in the public cloud would be sent via secure channels to the bank’s private cloud containing payment processing system.

9 Conclusion
Cloud has not yet been widely accepted as a new IT infrastructure model in banking sector but the situation is slowly changing. Banks will invest much in the cloud in coming years.

Core processes will be the last to be operated from the cloud but CRM and HR analytics will probably be the first ones. It is obvious that banks are examining cloud and maybe are even already operating some of their business on it. Private cloud will be the most interesting model, especially in early stages of its deployment. Hybrid and community clouds could provide some backup power to the private cloud.

It still remains to be seen whether the public cloud will be integrated in those systems and to what extent.

References: