

# *Application of Cloud Computing in Banking: Advantages and Challenges*

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**Abstract**—Cloud computing technology will bring to banks such advantages as cost savings, enhanced data processing capacity and improved quality of financial services. To further promote the application of cloud computing in the banking industry, the first and foremost task is to solve the security problem. Judging from the commercial banks, cloud computing should be applied step-by-step, gradually moving from the peripheral business to the core business. For large banks, to build their own private cloud is the appropriate way into the financial cloud. For small banks, using the cloud service provider's public financial cloud can quickly support the development of their business, and effectively bridge the information divide.

**Keywords**—cloud computing, cloud service provider, banks, information security

## I. INTRODUCTION

With the development of computing technology and business model innovation, cloud computing has become an important part of the new generation of IT change. The emergence of cloud computing makes various industries participate in the applications of that technology, and the banking sector is naturally no exception. At present, more and more banks have begun to consider migrating their traditional IT infrastructures to cloud computing solutions. For banks, cloud computing solutions have made the maintenance and use of information system infrastructures to the greatest degree of simplification. But at the present stage, they also bring a certain degree of challenge to banks in terms of data security, business continuity, and so on. Once these challenges can be resolved properly, cloud computing will be further promoted in the banking industry. In the future, banks may take advantage of cloud computing to create different business models, and give customers a whole new experience of the financial services.

## II. CHARACTERISTICS OF CLOUD COMPUTING

As a new Internet-based computing model, cloud computing manages and dispatches uniformly a large number of network-connected computing resources to form a pool of these resources, and then provide on-demand service to users. From users' perspectives, the resources in "cloud" can be infinitely extended, and can get at any time. Currently, Cloud computing services are mainly as follows: infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), hardware as a service (HaaS), data as a service (DaaS) and application as a service (AaaS).

In general, cloud computing have the following characteristics:

### A. Powerful computing power and storage capacity

Cloud computing distributes computing and data across a large number of distributed computers, thus forming a powerful computer to provide powerful computing capabilities for a variety of computing, and complete computing tasks that traditional computers are unable to do. Meanwhile, compared with data storage space of usual computers, there is much larger data storage space in "cloud". Personal computers or other electronic devices cannot provide an unlimited amount of storage space and computing power, but cloud computing can offer unlimited space to store and manage data.

### B. Lower equipment requirements of the client

Cloud computing provides users access to IT services without requiring ownership of the infrastructure or an understanding of the technology[1].As long as there is a computer with Internet access, and then type the web address in your browser, you can access to cloud computing services. Users can directly edit in the browser the documents which are stored at the other side of the cloud, and share information with others at any time. You no longer have to worry about whether the software is the latest version, because technicians will maintain hardware, install and upgrade software at the other end of the cloud [2].

### C. Virtualization and dynamic expansion

The "cloud" adopts virtualization technology, and support users to use a simple terminal device to log on "cloud" and get data and software resources. Users don't need to know the specific location for the running of an application. Cloud computing model is not for a specific application, and it can be constructed to fulfill a variety of applications according to users' needs. The same "cloud" is capable of simultaneously support multiple different applications. At the same time, the "cloud" size can be extended dynamically, thus to meet the needs of applications and user growth.

### D. Resource sharing

In cloud computing, resources of the computing infrastructure are provided as services of the internet. Cloud service providers pool together and manage IT resources to build a resource pool--"the cloud", and then allocate these resources according to the user's application. Users needn't to care about the specific implementation details. They just need

to get resources from the cloud and deploy them, and pay according to their actual usage. Cloud computing is characterized by sharing of resources, and can be dynamically adjusted. If the business volume of one application is getting large, more resources will be dynamically allocated to this application; and if the business volume of an application becomes small, then the resource will be returned. Thus, the average utilization rate of IT resources can be greatly improved.

### III. APPLICATION OF CLOUD COMPUTING IN BANKING: MAIN ADVANTAGES

Banking is an industry with the most extensive and in-depth application of information technology. With the emergence of cloud computing, more and more banks are considering the adoption of cloud computing to help them create values, and some banks have begun the actual adoption of that technology. To banks, cloud computing will bring great advantages of simplified IT management, reduced operating costs and improved service quality, as reflected specifically in the following four areas:

#### A. *Cost savings*

When cloud computing is adopted, banks do not need to purchase additional data center. Through cloud computing solutions, banks don't have to buy any servers, storage devices and network equipments, and all software, hardware and technical issues are delivered to a cloud computing service provider. Banks are able to get the most advanced technology applications without being equipped with professional technicians in IT; Banks does not require special maintenance and management personnel, and do not need to recruit such personnel at an additional cost. Through infrastructure services such as networks, servers and storage provided by the financial clouds, small and medium banks can build rapidly their IT systems with low-cost by hiring IT services, thus to realize data center outsourcing and on-demand deployment, and to greatly improve the system flexibility with reduced costs.

Cloud computing uses delivery model of on-demand and pay-as-you-go[3-6], so banks do not have to care about the technical parameters of the IT infrastructure, such as the performance and capacity of hardware system, and they need only to care about their own business. Banks may Invest in IT by means of relatively low "monthly fee", not a one-time investment and without taking too much of the working capital; Banks don't have to consider the cost of depreciation, and can timely get the latest hardware platform and the best possible solutions. More importantly, banks do not need to pay for the system that might be used in the future, and only to pay for the resources that are in use.

#### B. *Reduction of the risk of IT use*

Over the years, as buyer of IT technology, banks are passively under the influence of IT service providers from the technical direction, the system architecture to application software, which leads to high IT expenses and the lock-in of IT systems to a specific vendor's proprietary technology. With cloud computing, banks can obtain the infrastructure, the development platform and even application software through the procurement of services, without the need for a massive

one-time investment and a long, risky implementation process. Banks will not be limited to a certain hardware manufacturers' products and solutions because of compatibility requirements. As a result, the traditional IT vendors must compete in a public service platform, and banks will have more choices, which may completely changed "the rules of the game" and to a large extent reduce the cost and risk of the banks' IT use.

#### C. *Improvement of the agility of IT*

In the traditional mode, if banks want to deploy or expand a new application, they need to undergo a series of process including equipment selection, purchasing, installation and configuration, which may take several weeks or even months of time. Cloud computing has features of ease of use, manageability and rapid deployment, thus can greatly accelerate the deployment and expansion management of the banking IT applications. Under the cloud computing model, by applying to the cloud through the browser, banks can complete an on-line system within a few hours or a few minutes. The upgrade of cloud computing is also very flexible, which can support the dynamic changes of business to adapt to the rapid development of banking business requirements, and accelerate the pace of bank informatization construction. If, for example, banks require surplus computing power to meet temporary spikes in demand, they can get these in the cloud [7].For banks, cloud computing solutions have made the infrastructure maintenance and the use of information systems to the greatest degree of simplification.

#### D. *Enhancement of data processing capability*

Through cloud computing technology, the banking business data can be stored, analyzed, processed and mined in a short period of time, thus greatly enhance the bank's data processing ability. As competition intensifies, banks should subdivide the customer's marketing, and provide personalized service for different levels of customers, which put forward higher requirements on banks' data processing ability. In the context of large amounts of data, the traditional methods of data analysis are often difficult to provide timely analysis results. The distributed architecture in cloud computing provides a new way to implement data warehouses, and its advantages lie in the massive data mining and analysis. Compared with the traditional data warehouse in a single central structure, cloud computing greatly increases the data storage capacity and analysis speed. Through the combination of data mining techniques and cloud computing, banks can quickly extract valuable information from the huge amounts of data, which are helpful to improve the speed and quality of data analysis and facilitate banks' business decisions.

### IV. APPLICATION OF CLOUD COMPUTING IN BANKING: SOME CHALLENGES

In the face of new technologies, banks always take a cautious approach owing to the special nature of the banking industry. All banks will adopt a mature technology, not a new technology just appeared, and their attitudes towards cloud computing will also be so. Although cloud computing solutions are ready to provide benefits to banking industry, banks may have concerns about security and sustainability. In particular, at current stage, there are certain challenges to banks to adopt cloud computing technology.

### A. Information security issues

Data is the life of the bank. If bank data leaks, it will not only bring economic losses to the bank, but also greatly affect the development prospect of the bank. For cloud computing, the primary task is to solve the security problem in order to put down roots of that technology in the banking industry [8-10]. However, traditional information security problems still exist in the cloud computing, and also new security issues emerge because of its characteristics. For example, the data storage and destruction on cloud, as well as the effective construction of security trust system in cloud computing.

Cloud computing deprives clients of direct control over the systems that manage their data, thus may arise fears of the cloud[11].For banks, they of course hope to put more data in "the cloud", so that they may consume fewer resources and gain more benefits. But when more data are stored in the "cloud", it means that more data may be abused. This dilemma will let many banks hesitate to make the decision. Banking has a very high requirement on data security; if the workload is migrated to a shared architecture, it will definitely increase the potential risk of unauthorized access and information leaks. At the same time, the emphasized concept of cloud computing that "users do not need to worry about the physical location of the data but only to care about how to use", also makes a lot of financial executives have concerns and doubts[12]. If the hurdle of "security" cannot be tided over as soon as possible, it is difficult to gain banks' trust on cloud computing.

### B. Business security issues

By cloud computing, banks use IT resources and pay-per-use in ways of purchasing services from cloud operators, and computing resources can be extended or reduced at any time according to business needs. So, in a sense, cloud computing is a kind of socialization service mode of information technology [13]. Such an approach adapts to the requirements of improving efficiency in modern society, but also makes the bank exposed to possible risks. External cloud computing operators may not have sufficient capacity to meet the requirements of the bank, and also may terminate services because of their financial difficulties, which will pose a threat to the bank in providing continuous financial services. At present, the lifecycle of IT service vendors is difficult to guarantee, so the stability of cloud computing services will directly affect the safety of the bank's survival. Moreover, the existing cloud vendors are only just created, so they still fall short in terms of credibility. With the growing complexity of banking and increasing number of financial products, the data processing ability and risk control of cloud computing platform may suffer greater challenges.

### C. Lack of technical standards

Cloud computing have new concepts and technology forms, but it lacks industrial standards. On the issue of transferring to a pattern that lacks technical standards, the banking sector, whose business has been developing rapidly, will inevitably have great concerns. No standards may mean that there exist instability in architecture and difficulties in the convergence between systems; In the case of lack of security models and standards of cloud computing architecture, cloud computing

service providers may avoid most of the security risks, and transfer them to users.

In cloud computing mode, a large number of bank customers' data are stored and managed centrally, which may involve the depositors' interests, personal information security, privacy protection, service continuity and many other issues. Therefore, sound laws and regulations are necessary to safeguard information security and quality of service. However, policies and regulatory rules on the application of cloud computing in banking are not yet perfect.

## V. CONCLUSION

As the technology matures, cloud computing is bound to have a wide range of applications in the financial sector in the future. Generally speaking, cloud computing solutions can be firstly adopted at banks' peripheral businesses, and then gradually move closer to their core businesses. For big banks, they can start from "private cloud" to improve IT infrastructure security and high availability of IT infrastructure, and achieve on-demand IT infrastructure services; on this basis, big banks can gradually try "public cloud" and "hybrid cloud". Relative to big banks, small banks are scarce in capital, technology, talent and other resources. So these banks are obviously difficult to establishment their own data centers because of the high cost. For many of the small banks, adopting the public financial cloud services of cloud service providers should be a better choice. As for the cloud service providers, they should do greater investment in security and to further understand the objective needs of the banking industry, thus to work out cloud computing application solutions with high availability, high business continuity and high flexibility that are enough to support the banks' business development requirements.

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