

Research on the Application of Cloud Computing-Related Technologies in Enterprises - Taking China Everbright Bank as an Example

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Abstract. With the rapid development of information technology, cloud computing, as an emerging and efficient computing model, is profoundly changing the IT architecture and business operations of enterprises. This paper selects China Everbright Bank as the research object and comprehensively and deeply analyses the practical application of cloud computing-related technologies in Everbright Bank. The study found that cloud computing technology not only provides essential technical support for the digital transformation of enterprises and promotes the optimisation and upgrading of business processes, but also becomes a key factor in increasing the economic benefits of enterprises and enhancing market competitiveness. Through the introduction of cloud computing, Everbright Bank has achieved remarkable results in improving data processing capabilities, reducing IT costs, and enhancing business flexibility, further consolidating its leading position in the financial industry. It provides strong support in enhancing the convenience of urban and rural residents' lives, narrowing the regional gap, promoting balanced resource allocation, and equalizing public services. Domestic financial institutions in the depth and breadth of cloud computing applications with the international leading level there is still a gap, but in the policy support and market demand, the future is expected to catch up, and further release the potential of cloud computing in the financial industry.

Keywords: Cloud Computing; Enterprise Applications; China Everbright Bank; Cloud Toll Collection.

1. Introduction

At present, the rapid development of cloud computing and its broad prospects have attracted a high degree of attention from many governments, and the United States, the European Union, Japan, South Korea, India and other countries and regions have accelerated the promotion of the development of cloud computing through the formulation of strategies and policies, increased investment in research and development, and accelerated the application of other ways. Our government is also extremely concerned about cloud computing, and actively layout development. In recent years, China's government has issued a series of policy documents to support the development of cloud computing, aiming to accelerate cloud computing technology innovation and application promotion, and to promote the healthy development of the cloud computing industry. These policies not only provide a favourable development environment for cloud computing enterprises, but also promote the in-depth integration of cloud computing and traditional industries, and promote industrial upgrading and transformation. Under the active guidance of the government, China's cloud computing market has shown a booming development trend, cloud computing technology continues to innovate, and application scenarios are becoming increasingly rich, injecting new vitality for economic and social development. This article aims to explore the application practice of cloud computing in China Everbright Bank and analyze its impact on the economic benefits of enterprises.

Cloud computing occupies a central position in modern information technology, driving the development of distributed computing, virtualisation and automation technologies and accelerating digital transformation. Its resource-sharing and rapid deployment capabilities enhance efficiency and support telecommuting and global collaboration. Research gaps include the convergence of edge computing and cloud computing, quantum computing in cloud computing, AI-driven resource management, security in multi-cloud environments, privacy-preserving technologies, environmental impact optimisation, and transnational legal compliance issues. These areas need to be further

explored. The paper is organised as follows: after the introduction, Section II presents the concept and development overview of cloud computing, and Section III and Section IV are the main body of the paper. Section III illustrates the practice of Everbright Bank's application of cloud computing to achieve convenient services, followed by a discussion of Everbright Bank's cloud computing application revelations in Section IV, and finally, a conclusion in Section V.

2. Introduction to Cloud Computing

2.1. The Concept of Cloud Computing

Cloud computing, as a key force in today's digitalisation wave, has the core advantage of being an “enabler” for business development. Focusing on the cost-benefit dimension, in the past, the capital investment in the construction of local server clusters for the purpose of guaranteeing business arithmetic demand was said to be a “bottomless pit”. Not only to spend a huge amount of money to purchase a large number of hardware equipment, with the expansion of business, but also have to continue to make additional investments, just to expand the arithmetic. More problematic is that hardware maintenance is also a major problem, professional operation and maintenance team is essential, equipment ageing, sudden failure and other problems occur frequently, manpower, material and financial costs are stacked and the enterprise is overburdened [1].

The advent of cloud computing has revolutionised the situation. It innovatively introduced a pay-as-you-go model, and enterprises have since said goodbye to the past sloppy resource allocation. Just like the use of water and electricity, based on the real-time business volume, flexible increase or decrease in the call of cloud computing resources to accurately match the demand. In this way, the high capital expenditure in the early stage is greatly reduced, and the long-term operating costs are also effectively controlled, so the enterprise can break free from the heavy cost shackles, and divert the valuable capital to the core business innovation field, injecting a constant power for its own development [1]. Cloud computing relies on the Internet, enabling users to access and use data, software and hardware resources on cloud platforms anytime, anywhere, across geographic constraints. The preprocessing mechanism significantly improves system computing efficiency and reduces computational errors by optimising data structures and algorithmic processes. Cloud computing technology draws on this concept, and its core lies in building a virtualised pool of resources at scale. The resource pool integrates infrastructure such as distributed storage, parallel computing and network communication, and it is capable of real-time processing of computing tasks and data requests generated by massive user terminals in the networked state. Through intelligent resource scheduling algorithms and load balancing mechanisms, the system manages and distributes these dispersed computing demands in a unified manner, forming an elastic and scalable service network, i.e. a “cloud” platform. The distributed computing model implemented based on this architecture is the core operating mechanism of cloud computing [2]. Cloud computing is based on a large-scale distributed computing model, driven by economies of scale to achieve efficient integration and dynamic expansion of resources. The computing power, storage, platforms and services in this model are abstracted, virtualised, dynamically scalable and uniformly managed and maintained by the cloud service provider.

2.2. Domestic and International Research Status

Long before the concept of cloud computing was introduced, Amazon had already been practising cloud deployment within the company. Amazon has designed a cloud service (Amazon Web Service, AWS), a service that focuses on utilising normally unused IT resources. In 2007, the International Business Machines Corporation (IBM) launched the Blue Cloud (Blue Cloud) service, bringing customers a buy-as-you-go cloud computing platform. In 2008, IBM cooperated with the Wuxi Municipal Government to establish the Wuxi Software Cloud Computing Centre, which began the commercial application of cloud computing in China. Subsequently, more and more information technology enterprises are involved in cloud computing applications. Baidu, Ali, Tencent, Wave and

other domestic enterprises have laid out cloud computing, respectively, from different perspectives began to provide different levels of cloud computing services. In October 2010, the State Council issued the ‘Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries’, which set cloud computing as one of the strategic emerging industries in the ‘Twelfth Five-Year Plan’. In March 2017, the Ministry of Industry and Information Technology issued the Three-Year Action Plan for Cloud Computing Development (2017-2019), stating that by 2019, the scale of China's cloud computing industry will reach 430 billion yuan, breakthroughs in a number of core key technologies, the cloud computing service capacity to reach the international advanced level, and the level of application of cloud computing in the fields of manufacturing, government affairs and other fields will be significantly improved. It will become the main form of informatisation construction and an important support for the construction of a strong network country and a strong manufacturing country, and it will promote a substantial increase in the level of informatisation in all fields of the economy and society.

3. Cloud Computing Application for Convenience Services in China Everbright Bank

3.1. China Everbright Bank Overview

China Everbright Bank, a national joint-stock commercial bank headquartered in Beijing, was established in August 1992 with approval from the State Council and authorization from the People’s Bank of China. It achieved its initial public offering on the Shanghai Stock Exchange in August 2010, followed by a listing on the Hong Kong Stock Exchange in December 2013, marking significant milestones in its expansion as a leading financial institution. China Everbright Bank, relying on Everbright Group's advantages in integrated finance, industry-financing synergy and cross-border operations, focusing on customers, accelerating innovation in products, channels and service models through integrated, specialised, lightweight and digital development, shifting from operating its own balance sheet to helping customers improve their financial statements, cultivating strong competitive advantages in the market in the areas of wealth management, fintech and integrated finance, forming a balanced development of various businesses, increasingly improved risk management, and continuously enhanced innovation and service capabilities, and move steadily along the track of high-quality development.

3.2. Application Practice and Effectiveness of Cloud Computing in China Everbright Bank

3.2.1. Status

China Everbright Bank started to explore the construction of a cloud platform in 2012, from the 1.0 stage with virtualisation technology as the core to the 2.0 stage with cloud management as the core, and in 2022, it entered the cloud platform 3.0 - full-stack cloud platform construction stage. At the end of 2019, Everbright Bank put forward the idea of developing a full-stack cloud platform, with “full-stack” meaning “bank-wide,” “full-resource,” “full-service” “full stack” means “full bank,” “full resources,” “full service,” and “full business”. Everbright Bank's bank-wide unified planning and construction of bank-wide production cloud, development and testing cloud, financial ecological cloud; based on the full-stack cloud platform base to provide x86 arithmetic, ARM arithmetic, GPU arithmetic, object storage, distributed file storage, software-defined network and multi-availability zone disaster recovery and other resources; on the basis of IaaS services such as computation, storage, network, etc., to provide container clusters, self-developed databases, middleware and other on the basis of IaaS services such as computing, storage and network, it provides container clusters, self-developed databases, middleware and other PaaS services, which are uniformly managed by the cloud management platform, and outputs technological resources and technological capabilities in a service-oriented manner. In 2022, Everbright Bank's full-stack cloud platform has initially completed the construction of a “dual-stack and one-stack multi-core” two-location, multi-center distributed

cloud data centre, built a bank-wide unified digital infrastructure system, and provided 9 categories and 35 types of cloud services for the head office, credit card centre, and 39 branches to achieve one-stop operation and maintenance services for localized hardware and software resources such as bare metal, cloud servers, cloud storage, cloud networks, and container clusters, etc. Cloud IaaS resources support minute-level delivery, support for business application cloud native transformation and multi-live deployment. It provides one-stop operation and maintenance services for localised hardware and software resources such as servers, cloud storage, cloud network and container clusters, supports minute-level delivery of IaaS resources on the cloud, supports native transformation and multi-live deployment of business application cloud, and carries more than 30,000 cloud hosts and 30,000 container PODs, with the rate of business application systems going to the cloud approaching 90%.

At present, Everbright Cloud Bill Payment provides nearly 1,700 basic bill payment services for water, electricity and gas in Digital RMB APP, covering 31 provinces (autonomous regions and municipalities directly under the central government) nationwide, and has become the first cooperative organisation within the channel of Digital RMB APP to provide nationwide living services directly to customers. During the eight-day holiday of the Spring Festival in the Year of the Snake in the Year of the B6, Everbright Cloud Payment guaranteed a total of 47.93 million payment collection services for water, electricity, gas, social security, park tickets, property and other payment services nationwide, with a service amount of 8.2 billion yuan. In order to further stimulate consumption vitality, Everbright Cloud Payment also carried out a series of activities during the Spring Festival, such as the “Spring Festival Love Family and Save Money Week” and “Payment Spring Festival Reduction Gift”. At the same time, Everbright Cloud Bill Payment gives full play to the advantages of the integrated platform of “Finance + Life + Service”, relying on cloud computing and big data real-time monitoring system and other technical means, to achieve uninterrupted 24/7 service during the Chinese New Year period, with zero system failures and zero delays in transaction processing, and to provide hundreds of millions of users with highly efficient and convenient cloud-based bill payment services. Service for hundreds of millions of users.

3.2.2. Impact

The powerful arithmetic and rich technical services provided by cloud computing, such as AI arithmetic services, container cluster services, database services, etc., provide strong support for Everbright Bank's business innovation. Based on cloud computing and big data analysis, Everbright Bank has built digital service platforms such as “Cloud Payment”, “Everbright Payment”, and “Circulation”. The “Cloud Bill Payment” platform has accessed 18,123 online bill payment items, and exported to 880 merchants such as WeChat, Alipay, and Jitterbug, constantly expanding the boundaries of convenient services; “Optical Payment” provides multi-mode payment services for central and state-owned enterprises' e-commerce platforms, large-scale bidding platforms, and Internet-head e-commerce platforms. BrightPay provides digital integrated payment and settlement service solutions for central and state-owned enterprise e-commerce platforms, large-scale bidding platforms, and Internet-headquartered e-commerce platforms, such as multi-method merchant authentication, multi-channel online payment, multi-functional fund settlement and multi-dimensional platform management. According to Everbright Bank's official website, as of the end of 2022, Everbright Bank's total assets reached RMB 630.5 billion, an increase of RMB 398.4 billion, or 6.8%, from the beginning of the year; of which total loans amounted to RMB 3,572.3 billion, an increase of RMB 265.0 billion, or 8.0%, and accounted for 56.7% of assets, an increase of 0.7 percentage points from the beginning of the year, with an optimised asset structure. Total liabilities amounted to RMB 5,790.5 billion, an increase of RMB 372.8 billion over the beginning of the year, or 6.9 per cent; the balance of deposits was RMB 3,917.2 billion, an increase of RMB 241.4 billion over the beginning of the year, or 6.6 per cent. Assets and liabilities grew steadily, and operating efficiency increased steadily. Everbright Bank's net attributable profit can be seen in Figure 1. As of the end of 2022, Everbright Bank's net attributable profit reached RMB 44.81 billion, an increase of RMB 7.46 billion from 2019. Everbright Bank's net attributable profit has generally on a growth trend from 2019 to 2022, but the growth rate is volatile. From the above data, it is known that the application

of Everbright Cloud Bill Payment has increased the total assets of Everbright Bank, which has led to a growth trend in its economic efficiency.

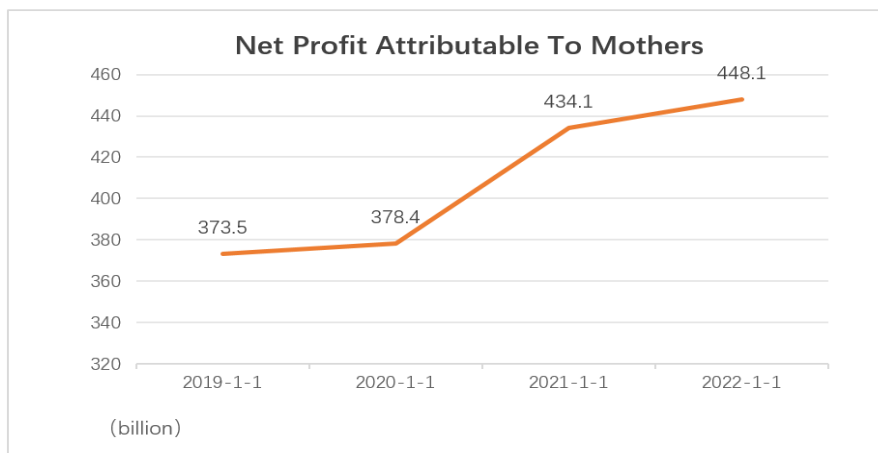


Fig 1. China Everbright Bank's Net Attributable Profit 2019- 2022.

Data source: Oriental Fortune

In recent years, China Everbright Bank and the Digital Currency Research Institute of the People's Bank of China have continued to deepen the application of digital RMB in the field of convenient payment, effectively enriching the use of digital RMB. Everbright Cloud Bill Payment is now included in the 'Life Bill Payment' and 'Mobile Phone Top-up' sections of the Digital RMB APP. By the end of 2024, the service amount exceeded RMB 100 million, a year-on-year increase of 206%, and the number of service transactions exceeded 1 million, a year-on-year increase of 141%. As an open convenient payment platform, Everbright Cloud Payment has now accessed 18,123 online payment items, exported to WeChat, Alipay, Jitterbug and other cooperative merchants 880, with nearly 3.4 billion service trips and more than 900 billion yuan of service amount in 2024, and the digital convenient service has run out of acceleration. The incorporation of cloud computing yields substantial importance across a wide array of industries, and small and medium-sized enterprises (SMEs) in particular must not be overlooked in reaping these benefits. SMEs play a pivotal role in Malaysia's economic landscape, constituting a staggering 97.2% of all enterprises. They serve as powerful engines driving economic advancement, spawning a wealth of job prospects and fueling innovation. In the context of Malaysia, these businesses contribute a significant 37.4% to the nation's gross domestic product (GDP) and account for 47.8% of the overall labor force, underlining their indispensable part in fostering the country's economic prosperity[3].

According to the data, it was found that the development of cloud computing applications had a great boost for Everbright Bank's online bill payment business. Everbright Bank released the '2024 China Convenient Payment Industry Report', which shows that the digitization of personal payment continues to deepen, and the proportion of online payment has reached 77.77% in 2023, which is nearly 30 percentage points higher than that in 2018; in 2023, the online payment rate of rural areas has reached 76.21%, and the gap with the urban areas has further narrowed, and the new quality index of China Convenient Payment in 2023 is 89.39, up 2.08 from the previous year, a steady increase for the seventh consecutive year.

4. China Everbright Bank Cloud Computing Application Revelation

4.1. Existing Deficiencies and Challenges in Cloud Computing Applications

4.1.1. Security and privacy issues

Data stored on the cloud faces multiple risks and challenges, firstly, the risk of data leakage, including the potential threat of hacker attacks and insider leakage; and secondly, the compliance challenge, as different countries and industries have stringent regulations on data privacy and storage

(e.g., GDPR, HIPAA), and organizations need to ensure that their cloud service providers are compliant with these requirements in order to avoid legal and operational risks.

4.1.2. Technical complexity

Organizations face the twin challenges of managing complexity and skills gaps when managing cloud infrastructure. A study by Al Hadwer et al. (2023) and Alshamaila et al. (2013) found that top administrative support, organizational preparedness, and firm size significantly influence the adoption of cloud computing among SMEs in northeastern England. Additionally, Gangwar et al. (2015) identified top management support and perceived organizational readiness as crucial factors for cloud computing adoption. According to Trigueros-Pneciado et al. (2013), several key barriers to cloud computing adoption in industrial SMEs persist, including employee resistance influenced by management, insufficient top management support, and a lack of technical support [4].

4.1.3. Incomplete laws and regulations

Under the cloud computing application mode, the lag of laws and regulations has become a key factor restricting the network information security guarantee. With the high-speed iteration of information technology, especially the in-depth application of emerging technologies such as cloud computing, big data and artificial intelligence, cybersecurity threats have taken on a diversified and complex character. However, it is difficult for the existing legal system to adapt to the rhythm of technological development, and it often faces the dilemma of insufficient legal basis and lagging disposal measures when responding to new types of cybersecurity incidents [5].

4.2. Recommendations for Cloud Computing Applications

4.2.1. Strengthen research on cloud computing-related technologies

Strengthening technology research and development is a key initiative to enhance network information security in the cloud computing environment. As the core driving force to ensure network security, enterprises should establish a systematic technology research and development system, focusing on breaking through the bottleneck of security protection in the cloud computing environment. Specifically, enterprises need to build a regular security operation and maintenance mechanism, through regular security vulnerability scanning and risk assessment, timely detection and repair of security risks in the system and applications [5]. First, selecting and integrating the appropriate cloud service—whether Infrastructure as a Service (IaaS), Platform as a Service (PaaS), or Software as a Service (SaaS)—requires a clear understanding of their unique purposes and requirements. This procedure typically demands the utilization of diverse service providers, which in turn calls for a particular degree of IT proficiency. Firstly, configuring cloud services demands the establishment of auto-scaling mechanisms, load-balancing setups, and other associated services, all while adhering to service level agreements. This ensures that there is adequate server capacity to meet operational needs, without needlessly incurring expenses for idle resources. Secondly, given that cloud computing functions on a self-service and customizable basis, customers must familiarize themselves with the implementation procedures and the full range of available customization alternatives. This knowledge empowers them to tailor cloud services to their specific requirements, optimizing performance and cost-efficiency. Finally, the migration and management of data to the cloud is a complex undertaking that demands meticulous planning and precise execution. Critical considerations include transfer costs, diverse storage options, stringent data security measures, and the resolution of compatibility challenges that may arise when interfacing with different cloud platforms. Each of these factors plays a pivotal role in ensuring a seamless transition and ongoing, reliable data management in the cloud environment [6].

4.2.2. Improve laws to promote cloud computing development

Many governments have adopted 'cloud priority' policies as key national strategies. For instance, the United States introduced the Federal Cloud Computing Strategy to lower the costs of government digitization and boost the cloud service industry. Similarly, Europe incorporated research and

development, along with the promotion of cloud computing technology, into the 'European 2020 Strategy' to advance digital growth across the continent [7]. The utilization of cloud computing technology enables the government to integrate data. Additionally, from the user's perspective, it leads to greater cost and time efficiency, eliminates risks, and removes the need to provide additional space [8]. Chinese government departments need to focus on improving the industry standard system, establishing a sound regulatory mechanism for cloud computing services, and promoting the popularization and application of cloud computing technology in the construction of accounting informatisation for small and medium-sized enterprises (SMEs) through a combination of policy guidance and market regulation. Exploring the adaptability of components across various industry settings can provide insights into differences between industries or sectors, potentially influencing cloud adoption [9]. This top-down promotion strategy will not only enhance the digitalisation level of SMEs, but also promote the benign development of the cloud computing industry, and ultimately realise the synergy between technological innovation and industrial upgrading [10].

5. Conclusion

This paper finds that in recent years, cloud computing technology has deeply empowered the financial industry, and companies have been researching cloud computing and applying it to a variety of areas, such as data storage, computational analyses, software development, and collaborative work, in order to reduce costs, improve efficiency, and enhance flexibility and innovation. This can be possibly explained by the fact that, for example, Everbright Bank has achieved real-time computation of intelligent wind control and improved customer service response efficiency by building a hybrid cloud platform, while using containerization technology to dynamically schedule resources, resulting in improved resource utilisation and lower operating costs. This book firstly explains the concept of cloud computing, and then mainly talks about the impact of cloud computing applications on Everbright Bank, which is helpful to show the positive impact of cloud computing technology application in the enterprise on the enterprise. The survey in this paper does not fully study all enterprises and only takes Everbright Bank as an example, which is not universal. Finally, the application of cloud computing technology in Everbright Bank provides baby experience and inspiration for Chinese enterprises, on the one hand, enterprises should strengthen the research of cloud computing related technology, on the other hand, and the government should improve the laws and regulations related to cloud computing to promote the rapid development of cloud computing technology. In the future, cloud computing will continue to be applied in enterprises, and enterprises need to explore the convergence architecture of multi-cloud collaboration and edge computing to support financial-grade high concurrency scenarios. Enterprises can also research and develop AI-based cloud-native security protection system and build a zero-trust model that meets the requirements of financial regulation to create greater value for enterprises.

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