CMB creates value that Internet finance companies cannot match

Through joint innovation with Huawei, China Merchants Bank aims to build cutting-edge distributed database products that give a competitive edge for banking services, drive CMB's digital transformation, and help CMB become a fintech enterprise.

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In the late 1990s, an incident occurred at a major branch of China Merchants Bank (CMB) in a provincial capital: Some banks dispatched several armored cars to the branch, telling CMB's customers they could withdraw their money if CMB couldn't find a way out. CMB employees called in family members to help carry their money, and the employees smiled through their tears when saying goodbye to customers. No one complained. A few weeks later, the branch was back to business as usual. Customers brought back the money they had withdrawn from the branch along with money they had withdrawn from other banks. In a short time, deposits in this CMB branch had doubled.

This story is one small step in the development of CMB, China's first share-holding commercial bank whose shareholders include legal enterprise entities.

CMB was also the first Chinese bank to hold umbrellas for customers coming in and out of the bank on rainy days, own auto call distributors, and provide milk for customers. These kinds of thoughtful touches have helped CMB develop rapidly over the past 30 years. In 2017, the bank ranked 23rd in the Banker's Top 1000 Banking Brands and 216th in the Fortune Global 500.

Three thoughts on CMB's digital processes

Over the past 17 years since joining CMB in 2001, I've witnessed the bank's ongoing digital transformation initiatives. In recent years, technologies such as cloud computing and big data have developed quickly. Keeping pace with the times, CMB introduced these innovations to achieve rapid service development and better serve customers. Several of the changes have impressed me deeply.

First is the rapid development of infrastructure. Our upgraded facilities and expanded capacity meet CMB's increased service requirements, from the bank's equipment room and data center in Shenzhen, our Nanjing disaster recovery data center, and our data centers in Shanghai and Pinghu.

Second is the impact of the Internet. CMB's top executives believe that technology can bring disruptive changes to banks — more so

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than strict supervision, small loan companies, or Internet financial companies. Therefore, CMB prioritizes new tech. For example, up to 40 percent of employees in the CMB business department spend 30 to 40 percent of their time on technology-related work and training. In addition, special funds have been established for innovative projects to support better service development.

These efforts have paid off. For example, CMB has built a unified risk control platform for credit cards based on Huawei's FusionInsight big data solution. The FusionInsight platform reduced the number of problem cases by 50 percent and saved more than 100 million yuan (US$15.6 million) in six months. This platform also shortened the time for issuing a credit card from 15 days to five minutes. CMB now supports the ability to issue loans up to 300,000 yuan within minutes. Furthermore, the bank leads the market to provide innovative services such as withdrawal authentication and flash payments.

The third change is what has impressed me the most: CMB's commitment to customer-centricity. With the slogan "We're here just for you," providing great services for customers is our foundation. We use fintech to facilitate our business operations and better serve our customers. We use every technology to satisfy customer needs, improve customer experience, and increase value. Our goals are more benefits, greater convenience, faster services, and considerate services for customers.

Internet financial enterprises cannot match us

The CMB Application and Database Management Office has been seeking answers to many questions: How do we provide better services for customers and businesses? How do we reduce costs? How should we set up our networks, and what architecture will be best?

CMB has strict architecture standards, such as read/write separation, database partitioning, active-active backup, and stateless multi-active operations. The bank has established a disciplined capability for implementation, and the gradual use of standard architectures has changed our standard for managing databases. In the past, faults had to be rectified immediately or services could not be restored. Now, with the standard architectures of today, faults have little or no effect on services. This use of standard architectures is an evolutionary way of thinking, as well as a great improvement in reliability.

CMB's efforts in these areas differ from those of Internet financial enterprises to some degree. We

implemented high-availability, high-scalability, and high-flexibility systems under strict supervision predicated on customer security and experience. CMB now compares favorably to Internet companies in terms of database architecture standards and implementation capabilities.

In recent years, technology development has generated more software, including operating systems, system software, and application software. More types of applications are emerging, including facial recognition, voice recognition, anti-fraud applications, and customer profile managers. These applications will evolve into public infrastructure services and be centralized. Those who can develop the best applications will encourage the most cooperation. Banks can take advantage of these services and have no need to develop their own. Such cooperation will become typical between banks and Internet or technology companies. Banks have the final say for the problems that can be solved using facial recognition, and where and how to use this technology.

Constructing a leading Distributed Relational Database (RDB)

Service innovations depend on IT and data. Therefore, it's critical to find a way to ensure information security and optimize the database.

If only one machine is used, its upper limit is fixed and once that limit is reached, more database instances are required. This requirement leads to new problems such as higher management costs. Before database partitioning, only one or two databases would be managed. With partitioning, 10 or more databases need to be managed. In addition, the probability of faults remains as high as when only one database is used. The result is that overall availability hasn't increased.

Database partitioning and horizontal expansion reduce the dependency on a single database. This approach seeks to balance the tradeoffs among resources, costs, availability, and development difficulty. The solution is to have a distributed database, which offers several advantages. First, it reduces cost, including hardware, labor, development, and O&M costs. Second, it simplifies development and O&M so that IT personnel have smaller workloads. Most importantly, this type of database better utilizes hardware resources and provides a higher unit output rate, so the database can support more services.

Distributed RDBs will never be outdated. Although this type of database has been under development for over 40 years, it's still used in scenarios with strict consistency requirements.

Single databases are encountering bottlenecks. In addition to throughput demands, the number of users and concurrent transactions have reached unprecedented levels and will continue to grow. In the future, once breakthroughs are made in technologies such as quantum computing, the transaction volume will again increase explosively. In this context, the distributed RDB is one of the best choices.

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Based on experience and a commitment to go further, CMB has decided to engage in a joint innovation program with Huawei in the distributed database field. We aim to build an optimal distributed database for the financial sector that will give CMB's services a competitive edge. Both companies will rise to the challenges of "Cloud First" by leveraging technologies such as cloud computing, big data, and AI, as well as leading financial business practices and high-quality resources to connect services and technologies. We will jointly develop the distributed database and put the products into use, migrating database applications to the cloud.

The performance and functions of the bank's existing open-source database kernel aren't comparable to a proprietary Oracle database. In addition, we have issues with scaling large clusters, low cost-effectiveness, and high maintenance costs. By cooperating with Huawei, CMB hopes to build a competitive distributed database for finance characterized by high performance, security, reliability, and scalability. We will use technologies such as latch-free data structures; NUMA (Non-Uniform Memory Access)-aware architectures; 3D-XPoint memory; high-performance distributed transaction processing, computing, and storage separation; Remote Direct Memory Access (RDMA); Group Buffer Pools (GBPs); and the Z-Paxos protocol. These technologies can build cloud-oriented scale-up/scale-out capabilities.

Over the years, the financial industry has gradually increased the value of the database, which is all about consistency. Databases play a critical role in data processing and solving consistency issues. Problems that can be solved by applications should not be handed over to the database, as databases may not be appropriate for problems better solved by applications. Moreover, coping with such problems is costly and affects database capabilities, including performance and capacity. In addition, fault probabilities are higher.

Based on these issues, CMB has clear specifications for online transaction systems. For example, even when using an Oracle database with a capacity for 500 SQL statements, CMB can only use 10 of them. This policy simplifies database function requirements, which shortens the development cycle.

Mutual trust builds cooperation

The customer-centric concept is the first reason why CMB chose Huawei. CMB exists to serve customers, and customer satisfaction is its highest priority. That is also true for Huawei. With a shared spirit of excellence, Huawei and CMB

respect, trust, and appreciate each other. Second, we believe in the strength that Huawei has accumulated from over 10 years of experience in the database field – including both in-memory and disk-based databases. The company has many successes in multiple business domains.

We also appreciate Huawei's service-minded approach and ability to face difficulties. About six years ago, Huawei left me with a deeply positive impression when CMB chose Hadoop products. At that time, several vendors, including Huawei, offered to provide Hadoop cluster products and services. After hearing CMB's six challenges, two of the vendors said the project was too difficult and dropped out. Only Huawei was willing to take on the challenge. Five months later, Huawei reported to CMB that five of the issues had been completely resolved and only half of the sixth issue remained. This demonstrated to me that Huawei is determined to deliver on projects and deal with difficulties with service awareness and cooperation. This is the foundation of our mutual trust.

How can the two companies use online trading systems and databases in the future? What services and capabilities need further development? CMB is a typical bank. Our interaction with Huawei is to propose advanced requirements and challenging functional attributes. Huawei sees that CMB has this capability and that the database developed by the two companies applies to banks as well as to businesses in other vertical markets supported by Huawei. I think that is why both parties choose each other.

Huawei is planning to develop a database on the public cloud, and CMB can assist with development. CMB will research the development trends of database technology and how to plan and design core databases.

This project will be highly beneficial to CMB, especially in terms of talent cultivation.

The joint innovation between CMB and Huawei has three phases:

- Initial phase: focus on commercial pilot projects in 2018.
- Growth phase: reach industrial scale in 2019.
- Stable development phase: carry out large-scale promotion and replication in 2020.

CMB is responsible for the design of requirements and solutions, and Huawei's Online Transaction Processing (OLTP) database team is responsible for technology implementation. Independent innovation will be conducted based on Huawei's experience, and infrastructures will be integrated based on new hardware capabilities. In this way, the project will achieve the overall objectives of high availability cloud-based deployment with high security, high performance, low cost, and differentiated competitiveness.

A three-layer product architecture will be adopted. The top layer is the distributed extension layer. The middle enterprise core layer will support the high performance and general database capabilities for enterprise-level services. The bottom layer is the distributed storage and cloud storage layer. This architecture supports the vertical integration of software and hardware to deliver high-performance, high-availability, and cloud-native database capabilities.

I believe that the distributed financial database jointly developed by Huawei and CMB will contribute to CMB's digital transformation and help CMB become a successful fintech bank. ▬▬