

An Introduction to Cloud Computing Platform

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ABSTRACT: Being immersed in the general and inevitable trend of the times, our country is step-by-step transforming itself into the stage of industrialization and modernization. Everything is coming down to ease, convenience and, above all, accuracy. Therefore, digital transforming is a great opportunity to close the gap towards the goal of becoming a much more developed country. Cloud computing plays a huge role in creating a revolutionary change in a good part of the economy, including Vietnam's banking system. Basically, it helps change the way existing resources are used, the operating structure by storing, distributing and processing information. Cloud computing application is becoming an inevitable course as it allows banks to integrate tasks through shared tools and platforms. As a result, decisions in economic movements are efficiently and promptly determined. The article focuses on introducing cloud computing platforms, digital transformation structures, analyzing the current situation, thereby giving recommendations on using cloud computing in the digital transformation of Vietnamese banks.

KEYWORDS: Cloud computing, digital transforming, technology platforms

I. INTRODUCTION

Digital transformation was given a new lease on life in the era of technology boom and the development of Internet ecosystem; therefore, it is playing a significant role in almost all aspects of an individual's exercises, an organisation activities, as well as business movements, especially digital businesses. Digital transformation is identified as the paradigm shift of the traditional model using human resources to the form of digital platforms by applying such inventions in technology – informatics as Cloud computing (Cloud), Big data, Internet of Things (IoT)... to help improving business operating methods, business models, offering good values for the business market.

II. AN OVERVIEW OF CLOUD COMPUTING

II.1. Definition

According to the Nation Institute of Standards & Technology (NIST), cloud computing is a facility that allows people to easily get access to shared computing resources (network, server, storage, applications, services) anytime, anywhere, on demand through a network connection. This cloud computing resource can be quickly set up or aborted by the user without the intervention of the Service Provider.

II.2. Characteristics

II.2.1. Self - service

Cloud computing services provide users with all the necessary digital utilities including networks, servers, storage, applications, services,... Users actively use it without depending on the hosting provider.

II.2.2. Convenient access

Users can access cloud computing and work anywhere and anytime without having to logging into the company's server at the premise.

II.2.3. Supply of resources

Cloud service providers can meet the demand of users by catering centers of data with modern infrastructure.

II.2.4. Instant elasticity

The service allows users to upgrade or decrease the amount of resources required in accordance with their needs from time to time.

II.2.5. Service measurement

Dịch vụ điện toán đám mây có hệ thống ghi và báo cáo lưu lượng sử dụng của khách hàng. Nhờ đó, khách hàng có thể biết chính xác lưu lượng tài nguyên mình đã sử dụng để thanh toán và điều chỉnh thiết bị sử dụng

Cloud computing service offers a system to record and report customers' usage. This allows them to manage the resources employment and to adjust their equipment.

II.3. Cloud computing classification

Cloud computing is classified in two approaches: cloud computing delivery model and deployment method. The classification will help users choose their appropriate type of service provided.

II.3.1. Categorization according to delivery model

Cloud computing offers three models including IaaS, PaaS, and SaaS. Each type has specific characteristics.

II.3.1.1. Infrastructure as a Service (IaaS)

IaaS provides users with pure infrastructure (usually in the form of virtual machines) as a service. Users can deploy the software on virtual machines like on a real server or can store personal data in the "cloud". Users do not have control over the physical infrastructure inside the "cloud" but they do have full control over the resources they are provided, as well as the demand to expand the amount of resources they are allowed to use.

II.3.1.2. Platform as a Service (PaaS)

PaaS provides the approach for the application development on a virtualized platform. It supports the application deployment regardless of the cost or the complexity of equipping and managing the underlying layers of hardware and software. It also provides for developers, computer managers, or end-users all the features required to enhance building and delivering an Internet-ready application and services without downloading and installing the software. PaaS allows developers to build the applications when troubles in setting up servers and databases have been solved by the PaaS provider.

II.3.1.3. Software as a Service (SaaS)

SaaS is an application deployment model that allows users to use the service on demand. SaaS suppliers can host the appliance on their servers or have it downloaded on the client devices, then disable it at the end of the term. On-demand functions can be internally operated to share the license of a third-party application provider.

II.3.2. Categorization according to cloud deployment method

II.3.2.1. Public Cloud

Public Cloud is the cloud computing infrastructure adopted by all customers on the service provider's shared infrastructure. Public Cloud is built for public use; users will register with the provider and pay usage fees on the basis of the provider's pricing policy. Public Cloud computing is one of the most popular models in the present time.

II.3.2.2. Private Cloud

Private cloud is known as facilities catered to users over their private intranet. It can also be called internal cloud. Private cloud offers businesses many of the same benefits as Public cloud, including self-service, scalability, and flexible expansion, with such additional features as control and custom support from dedicated resources on on-premises hosted computing infrastructure. In addition, Private cloud also provides higher level of security and privacy thanks to internal firewalls and storage systems to ensure the responsive data and corporate activities will not be accessed by third-party providers.

II.3.2.3. Hybrid Cloud

Hybrid cloud is the combination of public and private cloud power. It allows businesses to exploit the strengths of

individual model as well as offer optimal methods for users. These clouds are commonly created by the enterprise and management will be assigned to the enterprise and the public cloud provider.

II.3.2.4. Multicloud

Multicloud refers to the use of more than one shared cloud. This happens when the organization or customer avoids being dependent on one single cloud service provider. Instead, they choose the better facilities of each party for their work. Typically, businesses employ a number of different cloud service providers simultaneously such as Amazon Web Service, Azure Microsoft, and Google Cloud Platform... for their native applications.

II.4. Benefits of using cloud computing of banks

Application of cloud computing in the digital transformation of banks offers a certain number of benefits as followed:

II.4.1. Enhancement of bank-customer relationship

By providing greater control and access to real-time feeds and information, cloud computing helps financial institutions and banks acquire more information about customer habits and preferences so that they can meet their needs promptly at the appropriate time. At the same time, banks can also offer customers their efficiency, in-time information and improved accessibility, easily earning customer's trust for future service.

II.4.2. Guaranteed regulations on information system security

Most financial institutions and banks are concerned about the security when uploading data on the cloud. However, once financial institutions and banks store their data in the cloud, they have full management, processing, and understanding of their data. With the provision of cloud services to Vietnamese banks, cloud computing service providers are bind with the compliance with the Law on Cybersecurity and the regulations of the State Bank.

In addition, the State Bank also manage a legal lobby to protect information security when importing data in the cloud such as the Circular 18/2018/TT-NHNN in 2018 or the Circular 09 in 2019.

II.4.3. Cost-saving:

According to a survey by IDC Group Corporation, an average of 31% on IT infrastructure costs will be saved when an organization migrates their systems to the AWS cloud. A cloud computing system can help information technology infrastructure to deploy new products and services in just a few hours instead of months. Moreover, the Pay-as-you-go payment model (use as you go, pay as you go) will help financial institutions and banks reduce risks and costs of experimenting with new products and services.

Using cloud computing also saves system administration and operation costs by effectively utilizing the provider's information technology infrastructure in the cloud

computing environment. Based on that, banks can save infrastructure costs and introduce new applications and products more quickly and efficiently to customers.

II.4.4. More sustainable and transparent development:

Within the bank, cloud computing offers tight connection among departments through sharing data, using data analytics to immediately solve customer problems, improve customer experience, etc. Such creativity and cohesion helps financial institutions and banks retain high-quality personnel, increase consistency, and create a more transparent and creative working environment in the organization.

II.4.5. Enhanced flexibility:

Cloud services is one of the ways for financial institutions and banks to reallocate resources by managing information technology infrastructure, improving services from upgrading system configuration to meet market needs of potential customers such as customer visits to the system during "peak seasons", to lowering the configuration when the access demand decreases in order to increase the bank's business efficiency.

II.4.6. Acceleration of the development of new products and services:

With the traditional technology systems of most banks, it takes from months to years to launch a new product. With cloud computing, products are brought to market in just a few weeks. Sales teams can actively configure or modify products and processes themselves without relying too much on technology experts. Besides, the technology of cloud providers is always updated to adapt to work demands.

II.4.7. Enhancement of security:

The security of the cloud has always been the subject of debate among experts. However, customers' data will be more secure when using clouds from large providers than from a private cloud space. Cloud computing makes protecting customer data a top priority. OTP and Token authentication codes are also one of the security solutions developed from cloud computing. Besides, the scalability of the cloud makes it possible for banks to scan thousands of transactions per second. This significantly improves banks' ability to combat financial crimes such as money laundering and credit fraud.

II.5. Limitations on cloud adoption at banks

It can be seen that the application of cloud computing in data management and development of products and services of banks has brought a great number of benefits to banks, especially in the current digital transformation period. However, besides those desirable benefits, cloud computing also has some limitations that banks are concerned about.

II.5.1. Dependence on Internet connection:

Computing uses the Internet as a means to bridge providers and users, users and users. When the Internet malfunctions or the connection is lost, users cannot get access to the data in the cloud and as a result, they cannot use the data at their best.

II.5.2. Issues of security and privacy:

The fact that information used to be stored on hard drives helped users protect their data effectively. Regarding cloud computing, the data is put into the vendor's space. This carries the risk of information theft if the service provider's security system is poor. This leads to the situation that customers lack confidence in the quality of bank services when applying cloud computing in data management and product utilization.

II.5.3. Capacity of infrastructure construction:

Infrastructure has not been invested in sync with modern structures in comparison with that of large foreign enterprises.

Cloud computing services still have certain shortcomings such as shortage of products applied in the cloud ecosystem that prevents optimizing costs and operations for customers. Furthermore, Domestic cloud computing service providers are hesitant to bridge and support each other; so, it is difficult to develop and compete with foreign businesses.

III. THE APPLICATION OF CLOUD COMPUTING IN DIGITAL TRANSFORMATION OF BANKS IN VIETNAM

According to Forbes, cloud computing is one of the most significant innovations in the information age. "In the U.S., in 2020, if you were considering whether to transform to the cloud, you would be behind 90% of companies... Cloud adoption has been already widespread and the majority of enterprise workloads has already been in the cloud," the site stated.

Cloud computing was introduced nearly 20 years ago, but has only been in the boom in the past 5 years, and is becoming a proactive "race" in technology application. Netflix moved its entire infrastructure to the cloud about 5 years ago. Bank of America transported their data centers to the cloud two years ago. JP Morgan Chase cooperated with AWS (Amazon Web Services – Amazon's cloud computing platform) on data analytics. CBA Bank (Australia) claims that 25% of applications are being operated on the cloud, and in the next 5 years, this number will be over 95%.

It can be seen that cloud computing is an inevitably global trend and is no exception for Vietnamese businesses, especially in the banking industry. In the spirit of preparation and readiness for banks to apply cloud computing technology, the State Bank of Vietnam has guidelines and legal corridors to support banks. Specifically, in August 2018, the State Bank of Vietnam studied and issued Circular 18/2018/TT-NHNN on safety of information systems in banking activities, including regulations on management and use of cloud computing services in the banking industry. In December 2019, the State Bank of Vietnam issued "Information technology development strategy for Vietnam's Banking sector until 2025, orientation to 2030" which also determined that by 2025, 60% of Vietnamese banks will use the cloud and

by 2030, 100% of banks and credit institutions will use the cloud. In October 2020, the State Bank issued Circular 09, allowing banks to bring crucial data of levels three, four and five to the cloud if they comply with the attached regulations. We think this is a break-through Circular, promoting the trend of applying the cloud in banking industry.

Understanding the global trend and the strict legal corridor of the State Bank, some banks have pioneered the deployment of cloud computing technology.

III.1. Viet A Commercial Joint Stock Bank - VietABank

VietABank is the first bank in the Vietnamese banking system to move the entire Data Center system to Private Cloud computing environment.

In 2014, VietABank implemented the “virtualization” infrastructure and security restructuring project of Data Center Phase 1 - Building a new generation data center using “virtualization” technology, using cloud computing technology.

In 2015, the bank continued to implement the Data Center Security and Infrastructure Restructuring Project - Phase 2 - Building a backup data center of VietABank to ensure the safety of data and the continuity of transaction when there is an incident at either data center.

In May 2017, VietABank implemented a breakthrough infrastructure project on the Data Center which was moving the main Data Center and bringing all two Data Centers of VietABank to Private Cloud. The shift fully met the information management trend of the banking industry in technology management and brought outstanding benefits to VietABank. The cloud computing model chosen by VietABank integrates all distances and time, limiting the risk of local interruptions in transmission lines.

All VietABank employees operating throughout the territory of Vietnam can access the Data Center with the most

simplicity, safety and convenience, saving human costs as well as infrastructure management costs compared to the previous plan to build a physical data center. With high security, cloud computing gives service users different experience, as well as enhances the value of appropriate and sustainable development of the business.

In general, it can be seen that implementing a comprehensive Cloud Computing strategy for the Banking model is very difficult, so when VietABank brought data to the cloud, it immediately attracted the attention of the technology world, and businesses began to be more open to this technology.

III.2. Vietnam Public Commercial Joint Stock Bank - PVcomBank

PVcomBank is one of the leading banks in applying digitalization to promote the development of products and services, aiming to improve the experience, offering customers different imprints in using services.

In July 2021, PVcomBank and CMC Telecom's technology experts successfully deployed an integrated axis of service (ESB) system running on the OpenShift platform to AWS cloud. This is a significant step forward for PVcomBank's digital transformation technology projects in 2021 and the future.

The basic way of using ESB to integrate applications is to place an integrated axis in the middle of the applications and allow these applications to link and communicate with that integrated axis. This will keep the subcomponents of the system from being tied to each other and allow these components to communicate with each other through the integrated axis.

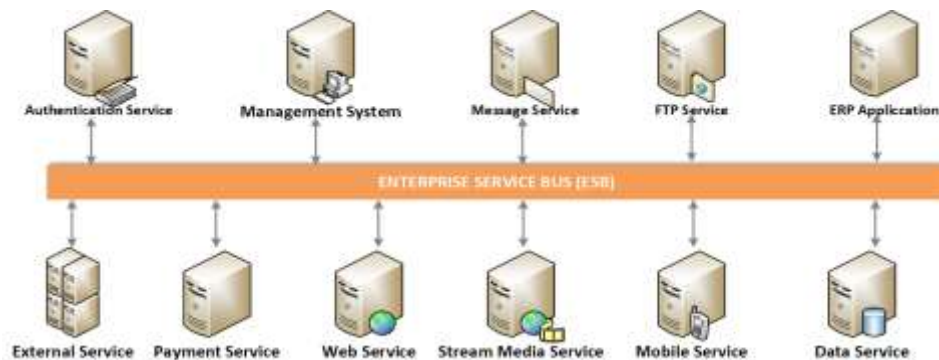


Figure 1. ESB interconnected shaft system Nguồn: easternsun.vn

ESB is the most important integrated axis system of the Bank that has been implemented by technology experts of CMC Telecom and AWS in collaboration with customers after a number of stages of testing and evaluating the infrastructure capacity to meet the requirements of strict compliance with regulations, requirements of the Finance – Banking industry. CMC Telecom is a digital convergence service provider

specializing in providing digital transformation solutions for Vietnamese businesses and multinational enterprises with branches in Vietnam. With telecommunications infrastructure and Data Center, CMC Telecom builds a digital transformation ecosystem for businesses, especially leading in Cloud services, and AWS is a leading cloud service provider in the world. As a result, the two providers gained

PvcomBank's trust to be chosen in this breakthrough infrastructure upgrade procedure.

The strategy of applying ESB model has contributed to the strong development of PVcomBank in recent years. PVcomBank's PV Mobile Banking feature alone has more than 200 functions to help customers make all transactions on "miniature bank, fit in your hand". In 2020, PvcomBank won the title of "Most Innovative Digital Bank 2020". In 2021, the bank was honored as "The Bank with the Best Service Quality in Vietnam 2021" and was in the Top 500 fastest growing enterprises in Vietnam 2021 – FAST500.

Mr. Trinh Vinh Hien, Deputy Director of PVcomBank Information Technology Division said: "As one of the first banks to implement a comprehensive digital transformation program and Open Banking, PVcomBank defines its long-term strategy to become a leading digital bank in terms of experience and performance of digital products and services."

III.3. Vietnam Joint Stock Commercial Bank for Industry and Trade - Vietinbank

In September 2021, according to Devops, VietinBank used a completely new architecture in which API Gateway was combined with available technologies of AWS cloud computing, and officially launched VietinBank iPay Web version to offer customers a completely new experience. This is a big step in the overall digital transformation strategy being strongly implemented at VietinBank, affirming its position as the leading digital bank in the market.

VietinBank iPay Web is the first digital banking product in Vietnam to operate entirely on cloud computing platform, with a uniform interface, providing a smooth performance on all Web browsers, computers and mobile devices. Not only brings convenient operations, simple movements when making transactions to customers, but the new version also breaks through with 41 completely new features, while 33 existing features are being improved and upgraded. The new version of VietinBank iPay Web is the perfect choice for customers wishing to use digital banking services via Internet browser.

Financial transactions, shopping and payments are easily made with VietinBank iPay Web. Such outstanding features that have been synchronized with the Mobile version as: Bill payment by credit card, card activation or locking, registration for card services, setting bill payments schedule, bill payment reminders, securities transfer, scheduled money transfer (within VietinBank and outside the system), Loyalty, air tickets booking, VNShop shopping, etc. Besides, VietinBank iPay Web also provides modern and secure Soft OTP and FacePay authentication solutions for financial transactions of high value.

III.4. Vietnam International Bank - VIB

On 27 September 2021, VIB and Microsoft Vietnam officially announced a 3-year strategic cooperation agreement

to deploy a multi-cloud computing platform with the use of Microsoft Azure as the main cloud for VIB.

VIB is one of the first banks to implement a multi-cloud model in Vietnam. This model uses multiple cloud computing services from different providers in a heterogeneous environment. Compared to conventional cloud deployments, this model offers superior flexibility when it comes to allowing banks to choose different cloud service providers to address specific, specialized requirements. In addition, multi-cloud computing allows VIB to deploy a new system or technology application in the shortest time, and the bank can also experience a good number of similar clouds; thereby choosing the most time – and cost – effective solution to better serve customers. Accordingly, users also have a more effortless experience with the bank's digital services.

Microsoft and VIB create a multi-cloud ecosystem with the use of Microsoft Azure as the primary cloud for VIB's applications, ensuring the same application can migrate or work properly on a second provider's cloud if necessary. Along with designing and accelerating the deployment of applications to the cloud platform, the bank will also modernize and transfer computing workloads including business applications and end-user computing needs onto this new platform to strongly promote VIB's digital transformation procedure.

The strategic cooperation of Microsoft and VIB in this agreement aims to accelerate the implementation of all new software development activities and major improvements in VIB's technology in the cloud. The continuous capabilities and innovations of Microsoft Azure will enable the bank to create a secure infrastructure with high speed and low latency, while reducing the cost of integrating the multi-cloud model with existing IT systems, thereby enhancing the user experience.

III.5. Vietnam Technological and Commercial Joint Stock Bank - Techcombank

On September 15, 2021, Techcombank announced a partnership with AWS provider in deploying the bank's cloud computing services. Techcombank would migrate the majority of applications from the bank's data centers to AWS, to leverage the scalability of cloud computing, and build an integrated data platform to optimize data analytics in the cloud. The platform will support real-time decision-making, enhance customer insights, drive innovation in new products and services, and improve customer service and online experience.

Techcombank will effectively harness the strengths of AWS' extensive range of cloud computing services to realize its vision of "Transforming the financial industry, enhancing the value of life". The bank also has a policy to invest in training programs to improve the capability of employees, and develop the talent pool when the bank successfully moves to AWS. More than 700 employees have been supported with cloud-based workplace skills through the

AWS Skills Guild platform. All employees of the bank will participate in basic training courses on cloud computing on digital platforms. AWS instructors will provide direct training to improve 2,000 students' capability. Techcombank will provide AWS Certified Cloud Practitioner training courses for technical and non-technical personnel.

Techcombank also uses the AWS Training network to connect and recruit talent for the bank. Activities hosted by the bank include online job fairs and recruitment campaigns focusing on recent college graduates who have accomplished AWS training certifications.

III.6. Southeast Asia Commercial Joint Stock Bank - SeABank

SeABank is known as one of the leading banks in digital transformation with hundreds of billions of VND invested in technology.

Most recently, on December 22, 2021, SeABank decided Google Cloud as its main cloud computing service provider. The bank has harnessed Google Cloud's expertise in technology services and capabilities to help businesses accelerate their digital transformation, aiming to cater SeAMobile/SeANet digital banking services on Google's cloud computing platform. This is the leading advanced, the safest and most secure technology in the world, which ensures stability, safety and high performance.

When using Google Cloud, SeABank will be able to quickly expand its services, migrate applications from the bank's data center to the cloud computing platform using safety features, flexible resource expansion and Computer Engine infrastructure platforms and Kubernetes Engine. Data analysis and understanding through Google Cloud applications will help the Bank query and analyze data instantly, enhance customer understanding, promote creation in new products and services, and improve customer service and online experience. Customers will be able to use smart financial services in a safe, secure and convenient manner. SeABank's selection of Google Cloud as its primary cloud service provider reinforces the Bank's commitment to using technology to enhance the way it interacts with and serves its customers – from anywhere and anytime.

Cooperating with Google Cloud is one of the important steps to help SeABank harness the power of Google Cloud's infrastructure and artificial intelligence capacity to innovate at a faster pace and on a larger scale, thereby optimizing the ability to deploy products, services, and systems, and enhancing customer experience. This is also in line with the overall digital convergence strategy that is being actively implemented at the bank.

IV. RECOMMENDATIONS

IV.1. Turning the “Cloud Computing” platform into an independent platform, which can be used and stored even when offline for short-term archive. This has been applied in temporary storage on such social networks as Facebook,

Twitter, etc. Even if there is no Wi-Fi signal, any of your electronic devices can perform operations in Digital Banking at ease, with anytime- and anywhere-transactions. Satellites also minimize transmission errors that we are experiencing today such as cable breakage, connection loss, connection instability, etc.

IV.2. Enhancing IT security, and customer information: the world of technology is constantly changing, cyber information thieves also have increasingly scheming tricks. The bank should not only look for good security services but also disseminate to their customers the self-protection of personal information from being exploited to leak information. Regarding the "cloud computing" system, issuers also need to create a separate end-to-end information protection system to support banks in managing information security more comfortably. Good catering of effective security will help banks easily gain trust and confidence of customers.

IV.3. Focusing on investment and development on at the same time: The State has always played a significant role in promoting digital transformation and cloud computing adoption. Therefore, in order for this policy to be carried out properly, the State needs to focus on directing and allocating resources reasonably, promptly supporting banks and regions that have not had access to this content. In terms of banks, to have a large " cloud computing " network, they should bridge with and cooperate with each other for mutual development.

V. CONCLUSION

Along with the development of the 4.0 Industrial Revolution, digital transformation in general or cloud computing in particular plays an important role in the development of the country. It represents a new breakthrough in storing, distributing, regulating and processing information that makes it easier for banks to enforce decisions and improve cycles. Although cloud computing plays an crucial and key role in digital transformation, and is believed to be taken full advantage of, there are still limitations and shortcomings that cannot be ignored. We need to actively face those issues and overcome the limitations in order to improve the cloud computing system, thus Vietnam's banking system will take a turn for the better and one day we will keep pace with major banks in the world.

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