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Preface

Similar to IT technology, the development of the cloud is accompanied by digital transformation, and has experienced trials and explorations entering the era of comprehensive practices at the current stage. While enterprises are enjoying the agility and innovation provided by cloud services, there are a series of challenges and pain points that come with it. Most enterprises cannot simply abandon existing systems and build entirely new platforms on the cloud. They must consider the requirements and limitations of talent, technology, cost, compliance, security, environment, etc., before transforming and building IT systems with multi-cloud visioning to support the sustainable development of businesses.

01 Multi-Cloud Overview

Chapter I Multi-Cloud Overview

Section 1 Overview of the Current State of the Cloud Market

Cloud computing is redefining how businesses effectively run, innovate and be more agile in developing new products and services. The scalability, agility and innovation of the cloud makes it an essential enabler to ensure the success of future business transformations.

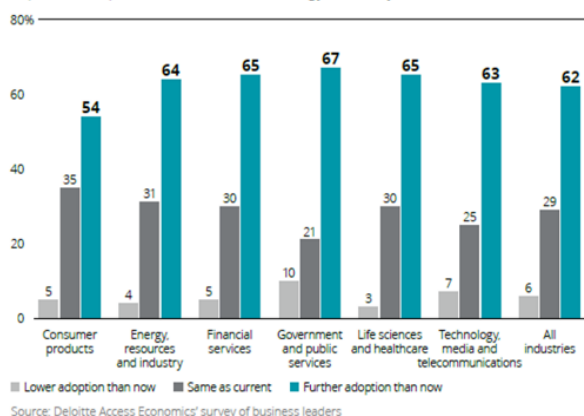
The global cloud market is growing rapidly

The global cloud computing market is growing rapidly. By 2025, total worldwide spending on and around cloud services will surpass \$1.3 trillion while sustaining a compound annual growth rate of 16.9%¹. Nearly 65.9% of application spending will be on cloud technologies, up from 57.7% in 2022².

In China, the cloud computing market has reached \$27.4 billion in 2021 and is expected to reach \$84.7 billion in 2026³. Driven by the need for digital transformation, Gartner forecasts that 40% of IT infrastructure spend by Chinese companies will be on the cloud by 2024⁴.

To understand the extent of cloud computing adoption and its impact on business operations, Deloitte Access Economics surveyed business leaders in IT strategy and digital transformation from 599 organizations across Asia Pacific in May 2021. More than 70% of business leaders say cloud computing enables their teams to experiment and innovate quickly and frequently and prepares them to address future challenges and organizational needs. About 60% surveyed expect their cloud adoption rate to increase within 3 years⁵.

Expected adoption level of cloud technology in three years' time



¹ IDC, Worldwide Whole Cloud Forecast, 2021–2025: The Path Ahead for Cloud in a Digital-First World, 202109

² Gartner, Enterprise IT Spending shift by 2025, 202209

³ Canalys, China's cloud spend up 45% in 2021 bringing high expectations for 2022, 202203

Near **80%** organizations surveyed said that cloud computing applications make them more comfortable with future challenges and organizational needs. Whereas **70%** also said cloud computing has allowed them to scale up or down quickly.

Cloud adoptions enable them to move faster and „ more frequently

Source: Deloitte Access Economics' survey

Multi-Cloud gradually prevails

There are two main domains of cloud computing services: public cloud and the private cloud (edge computing cloud, enterprise data center, private cloud, etc.). We refer to the multi-cloud market where multiple public and private clouds coexist to provide IT infrastructure services.

The global cloud market will reach \$145 billion in 2026, and Asia-Pacific will be the fastest-growing region globally. It is predicted that the compound growth rate of China's cloud market will be about 20% in the next 5 years⁶, the size of China's cloud market will reach 82.92 billion RMB in 2024⁷.

Cloud computing has experienced the evolution from a single architecture and single computing scenario to a more complex architecture and multiple computing scenarios, from public and private cloud to hybrid cloud or multi-cloud composed of multi-cloud, multi-edge computing, and multi-

⁴ Gartner, Best Practices for Public Cloud Adoption in China, 202205

⁵ Deloitte Access Economics Survey, 202105

⁶ IDC, Top 10 predictions for China's cloud computing market in 2023, 202301

⁷ Statista, Hybrid cloud market size worldwide in 2021 and 2027, 202207

enterprise data centers. Enterprises have started to deploy applications and data on multiple clouds and IT platforms. While enjoying the flexible and agile services brought by multi-cloud deployment, they may also encounter data isolation, "friction" between different heterogeneous platforms, and challenges regarding talent skills, management, and security compliance. In response to this demand, the "super cloud" architecture emerges with the natural evolution of the cloud. "Supercloud" is an emerging computing architecture that abstracts computing, storage, networking, security and other local tools, such as machine learning and development tools, from various underlying super-scale clouds into cloud services to create a global system that spans multiple clouds⁸. Both public and private cloud service providers have ideas to dominate and unify multi-cloud computing architectures and management platforms and build "super clouds" for enterprises to solve this problem.

Utilizing the existing mature framework, public cloud service providers are extending to the enterprise data center, edge computing cloud, etc., and trying to manage the enterprise data center and other private cloud services downward. Private cloud service providers or enterprises owned by private clouds try to establish a "cloud on cloud" (also known as the distributed cloud) to integrate the services of public clouds upward and become a compatible platform for the unified management of different cloud services as resources.

Regarding the "super cloud" architecture, VMware China architect believes that the emerging computing architecture is the natural evolution of multi-cloud and hybrid cloud, which is to solve the conflict of different heterogeneous platform caused by multi-cloud. Abstract all kinds of ultra-large computing, network, storage, security, and other native resources at the bottom into cloud service units, to build unified fundamental services across multi-cloud and enterprise IT.

Differences in cloud strategy and cloud readiness

1) Differences in cloud computing development between Global and China markets

Globally, the public cloud still dominates the cloud computing market with worldwide revenues grew to \$408.6 billion in 2021⁹.

Although started comparably late, the development speed of the cloud computing market in China is quite considerable. Enterprises in mainland China have embraced cloud native beyond expectations, and the potential demand and opportunities are worthy of attention. The size of China's public cloud market is expected to double in the future. Over the next few years, the rate of cloud migration in China will roughly keep pace with the rest of the world. Still, China differs from other countries in that, due to data security, compliance, and other regulatory factors, many Chinese enterprises prefer to host workloads in internal private cloud infrastructures¹⁰. IDC predicts that the dedicated China cloud services market will expand to more industries: The implementation of the 14th Five-Year Plan will accelerate the digital transformation process for traditional enterprises, and dedicated cloud services can address the cloud migration needs based on security, compliance, and speed and accelerate the success of digital transformation¹¹. In addition, the proportion of server and software expenditure of Chinese enterprises is about 5-10% worldwide, which is relatively low. These figures show that the cloud market has taken shape, but it needs to be combined and implemented with industrial applications to bring efficiency and deliver value.

As one of the two major data centers in Asia-Pacific, more than 75% of commercial enterprises in Hong Kong have adopted cloud computing services such as cloud servers, which will grow at a healthy rate and reach a market size of US \$1.95 billion in 2025¹². Hong Kong SAR government is also an end user of cloud computing. To consolidate Hong Kong's position as a leading digital city in Asia, the HKSAR Government launched the Government Cloud Infrastructure Services Program at the end of 2020 to start a new generation of government cloud services and facilitate the rapid development and delivery of digital government services.

In addition to resource management and cost savings, according to VMware Hong Kong cloud architect, Hong Kong companies also want to adopt a multi-cloud model to avoid single vendor lock-in while taking full advantage of each

⁸ Wikibon, Breaking Analysis: Brainstorming supercloud with tech leaders VMware, Snowflake, Databricks and more, 202208

⁹ IDC, Worldwide Public Cloud Services Revenues Grew 29.0% to \$408.6 Billion in 2021, 202209

¹⁰ Gartner, Adopt Hybrid Cloud to Overcome the Limitations of Private Cloud in China, 202205

¹¹ IDC, China Whole Cloud Market Forecast, 2021–2025, 202205

¹² Reogma, Hong Kong Cloud Computing Services Market, 2021

other. Enterprises can choose to deploy applications to multi-cloud services in a balanced way as Cloud Agnostic. On this basis, some enterprises will also choose to use cloud-based services to accelerate innovation.

In Taiwan, public cloud services are estimated to reach a market size of \$27.82 billion in 2025¹³ due to the rapid development of information and communication technology, which has brought a strong driving force to the growth of cloud computing. Multi-cloud or hybrid cloud has become the mainstream architecture for enterprises to adopt cloud computing services for digital transformation. At the same time, information security has become a key evaluation index for adopting cloud computing services by various industries in Taiwan.

2) Industry differences in Chinese enterprise cloud strategies

From an industry perspective, each industry has its own needs. For example, manufacturing companies have a high demand for data collection and processing performance throughout the process from procurement to manufacturing, so they prefer private cloud and edge computing cloud. Enterprises with few legacy systems, such as new retail enterprises or those with mature IT capabilities, have stronger demands for multi-cloud.

Banking and financial services are vital industries in Hong Kong, but their adoption of the public cloud is low due to regulatory, data protection and privacy concerns, and most take a cautious approach to cloud computing or prefer private cloud model.

In Taiwan, survey data show that manufacturing, construction, finance, retail and healthcare companies spend slightly more on the private cloud than on the public cloud¹⁴

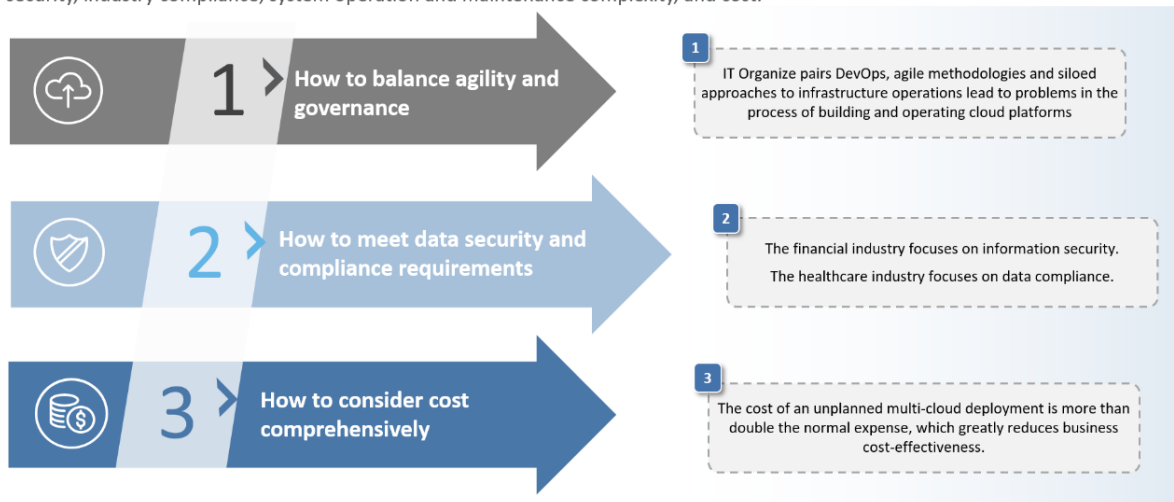


¹³ IDC, 2022 Industrial cloud adoption trend research, 202205

¹⁴ Researchandmarkets, taiwan-manufacturing-industry-cloud-spending, 202206

Section 2: Chinese Enterprise Cloud Strategy Confusion

Public cloud services do bring the benefits of agility and quick response to market demands while mitigating pressure on IT department. However, with the deepening adoption of public cloud services, it has also triggered discussions and concerns on enterprise data security, industry compliance, system operation and maintenance complexity, and cost.



Source: Deloitte Access Economics' survey

With the deepening of the digital transformation of the Chinese market, the response speed to the changes in customer demands is also accelerating, and the requirements for high performance, high availability and high scalability of IT infrastructure are increasing. The complexity of IT systems increases because many enterprises in China need to either re-purchase and upgrade their IT infrastructure, have a new understanding and choice of cloud strategy and selection, or have mixed cloud and traditional technology in their IT infrastructure services.

Public cloud services bring the benefits of agility and speed to the market and relieve the pressure on IT departments. However, the increasingly in-depth use of public cloud services also triggered the discussion on enterprise data security, industry compliance, system operation and maintenance complexity and cost, and thus generated a lot of concerns:

1) How to effectively balance agility and governance

Multi-cloud has become the new normal by providing a way to quickly access the agility, scalability, and cost-effectiveness of public clouds without abandoning traditional core systems. However, many IT organizations take an isolated approach to DevOps, agile methods, and infrastructure operations, which leads to problems in cloud platform setup and operations.

- Ignoring the deep binding between the business mid-platforms, it becomes easier to get on the cloud than to get off it. Enterprise cloud shall fully evaluate the need to buy or build the module.
- From an organizational perspective, the existing organizational structures of most enterprises are still not mature enough for cloud operations. While the cloud is a service-oriented IT interaction mode, enterprises' internal operations and structures are still traditional. Hence the SLA of the two is very different.
- From a talent skills perspective, with the continuous innovation of cloud service technology, the requirements for enterprise IT talent skills will change. The infrastructure level of the public cloud only needs consumption without construction. In the future, as resource integrators, the development team needs to have cloud-native architecture thinking and development skills, when a large infrastructure and data center team may become a burden. Different cloud service platforms require different skills, which is a challenge for the existing team. External recruitment will also increase the current operating costs of IT. At the same time, enterprises face realignment and allocation within the organization.

It is not easy managing the mix of technologies deployed locally and in the public cloud. Therefore, it is crucial to view the entire end-to-end IT organization and synchronize the parts. Traditional IT service management must also be

integrated with the cloud to ensure adequate support coverage.

2) How to meet the data security and compliance requirements

With the implementation of the Personal Information Protection Law and Data Security Protection Law in 2021, different industries have increasingly strict requirements on security and compliance, especially for the financial sector, state-owned large enterprises, etc. a private cloud is more conducive to the ownership and control of data. How to meet the requirements of different industries in a timely manner is also quite a problem faced by enterprises today.

Due to its particularity, the financial industry focuses on information security, which requires a tight network architecture and a very mature data storage and management. Financial enterprises must use hybrid cloud platform technology to build flexible and intelligent operation and maintenance security system architecture and realize automatic resource management through SLA rules to ensure business data security. The pharmaceutical industry focuses on data compliance, and the release of the network security "CPCS 2.0" system raises further requirements for data management of the whole hospital diagnosis and treatment processes. By deploying a highly elastic cloud platform, a medical and health hybrid cloud high-availability data platform is present, and a comprehensive security safeguard mechanism is built on the cloud to meet the requirements of "CPCS 2.0".

3) How to consider the cost comprehensively

Due to the lack of overall cost estimates for cloud services, many enterprise managers need to know precisely how many cloud services or functions are in use. In addition, the cost of adopting public clouds increases exponentially as

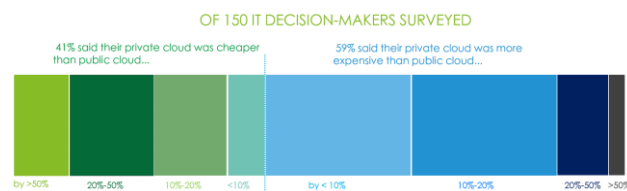
usage increases. However, due to the frequent workflow between different cloud platforms, the cost of multi-cloud deployment without thorough planning is more than double the regular expenditure, significantly reducing enterprises' cost efficiency and affecting their business value.

Public clouds have advantages over private clouds or enterprise data centers under scale effect. However, many research institutions have found that 41% of enterprises believe that the cost of private clouds is lower than that of public clouds. Many private cloud companies use operation and maintenance automation to improve efficiency and reduce costs.

Confusion about cloud strategy within enterprises is mainly due to their lack of capability to evaluate the overall cloud maturity of their application portfolio. This makes it difficult for strategic decisions, such as which applications need to go to the cloud or stay in the local data center, how to modernize local legacy systems, etc.

At the same time, each business unit in the user organization could manage the public and private clouds separately. Therefore, whether enterprises should build a cloud platform to achieve unified management can be controversial.

The above lists the confusion of the enterprise on the subjective level for the cloud strategy, and we will further analyze the problems and challenges in multi-cloud practice objectively.



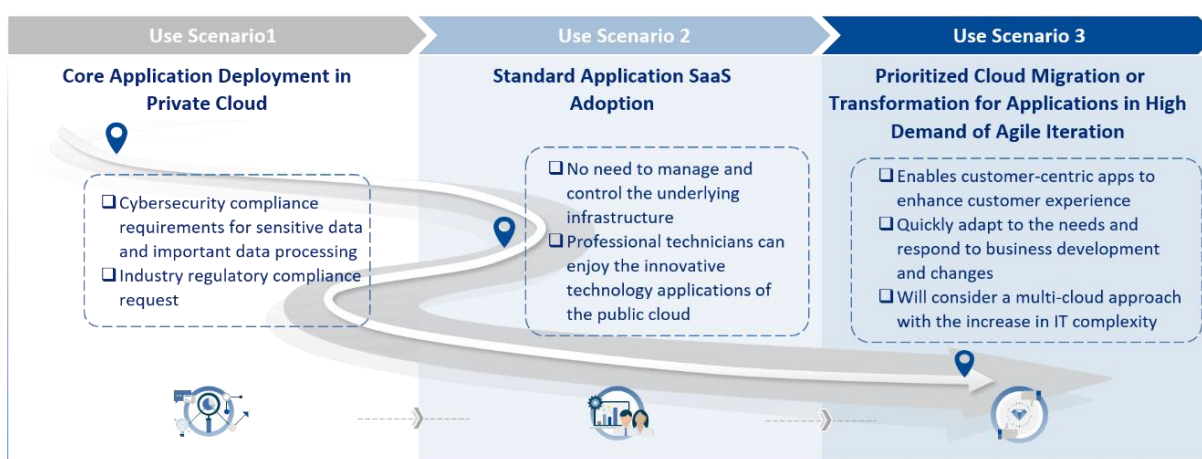
Source: VMware survey

Section 3 Multi-Cloud Practices and Challenges

Multi-Cloud Chaos

Industries and enterprises have different demands and visioning on public and private clouds. Cost is not the only deciding factor driving cloud service selection but also the complexity of system operation and maintenance, security compliance and others. At least in the current stage, there is no way for private or public clouds to replace each other, so there needs to be a balanced and harmonious symbiosis. For example, private clouds have advantages over public clouds regarding data ownership and security compliance.

There is no doubt that the current multi-cloud market is in a state of Multi-Cloud Chaos. Martin Casado, the father of software-defined networking (SDN), once wrote in an article, "You're crazy if you don't start in the cloud; you're crazy if you stay on it ", which is a very accurate description of a current situation. To be more thoughtful about being multi-cloud and avoid chaos, cloud computing experts list out some of the common practices that companies are using today:



Source: Deloitte Consulting China

Use Scenario 1: Core application deployment in private cloud

The core application systems, such as ERP, which stores and processes sensitive, important data and personal information, must comply with network Security and Data Security laws. Due to industry supervision, financial and pharmaceutical enterprises may consider deploying the core application system on the private cloud to reduce potential risks.

Case: A tobacco company

Current IT infrastructure from management and application perspectives is outdated and isolated, and enterprise IT support capacity is insufficient. To accelerate digital transformation, build the industry's integration platform, and comply with the technical trend, IT architecture is evolving from traditional to mid-platform architecture. It is necessary to redesign the infrastructure architecture and deploy all the enterprise core systems to the private cloud. At the same time, advanced technologies such as virtualization are introduced for infrastructure resource sharing, solving the potential problems of insufficient

support capacity of the machine room and related facilities, and building the basic operating environment and supporting platform.

Use Scenarios 2: Standard application SaaS adoption

For standard applications such as O365 and CRM, SaaS (Software as a Service) is an option for enterprises. In the SaaS service mode, application software is deployed on the servers of public cloud providers in a unified manner. Enterprise users need not manage or control the underlying infrastructure. They can subscribe to the specified application software services on demand and pay by service quantity, service time, or other methods. Enterprises no longer need to equip professional and technical personnel but also can enjoy the innovative technology application of the public cloud.

Case: An automobile company

In response to China's Personal Information Protection Law, which took effect in November 2021, the company's SAP

systems hosted overseas, including CRM, Hybris and other applications, need to be migrated from overseas and deployed to the public cloud in China. Improved user experience for Chinese users using CRM and Hybris systems through a sound early architecture design to ensure data security protection while meeting compliance and regulatory requirements. Improve the high availability and disaster recovery capabilities of the SAP system architecture by setting up cross-zone redundancy for multiple SAP applications and databases.



Use Scenarios 3: Prioritized Cloud Migration or Transformation for Applications in High Demand of Agile Iteration

For customer-facing applications that improve customer experience with customer-centricity, they must quickly adapt to requirements, respond to business development changes, and iterate agilely. Enterprises may choose to prioritize or transform them to the cloud, and want to take advantage of the rapid innovation of their technology, such as artificial intelligence and machine learning using massive amounts of data, by building in multiple clouds. As business complexity and the diversity of application ecosystems increase, enterprises may consider adopting multi-cloud integration solutions based on application features.

Case: A retail company

The company needs to respond quickly to market changes, develop and optimize automated customer journeys based on customer labels, support precision marketing, and improve customer conversion rate and loyalty. To focus on consumer asset operation, the company deconstructs its legacy core business system by using cloud-native technology, and building a new digital marketing platform. The project realizes continuous marketing model innovation and comprehensively improves core advantages such as product marketing, brand integration and customer service abilities.

The above three scenarios show that some traditional architectures need to be upgraded and optimized at the system architecture level to match the cloud-native standards, a process known as infra-up. To the business or application owners, it is necessary to consider whether the system can be conditionally reformed and choose the infrastructure configuration according to the actual business needs, but not necessarily pursue the cloud architecture. In other words, it is important to achieve application repatriating.

Challenges of multi-cloud practices

1) Complexity of operation model and unity of management

Nearly half of executives surveyed by Deloitte believe that the complexity of using the cloud (47%) will have the most significant negative impact on cloud ROI over the next five years. Executives believe large (37%), and mid-sized (33%) companies are most vulnerable to cloud complexity issues.

In many ways, using public cloud technology is like using a credit card. Buying and starting new services is relatively quick and easy, which is part of the speed advantage of the cloud. But as IT complexity increases and starts to run in a mixed environment, problems can arise when the business model needs to be aligned accordingly. One of the challenges of today's multi-cloud practices is how to effectively address cloud complexity, adopt a business model and management tools that support fundamental governance, and work seamlessly across cloud and local platforms.

2) Differences in application architecture deployment requirements

From the business perspective, the need for application updates and iterations has become increasingly significant to respond quickly to market changes. However, enterprises find that businesses have different performance and deployment requirements for their infrastructure. It becomes a challenge at the development level to deploy applications efficiently and spontaneously to the appropriate resource pool.

3) Guarantee of multi-cloud data interaction security

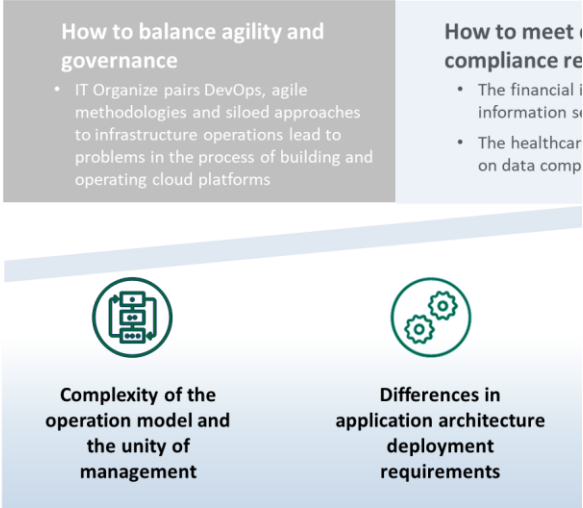
Within a multi-cloud environment, how to ensure data privacy and integrity, security and compliance when managing data across cloud services and realizing data backup have become a concerning issue for enterprises in multi-cloud practice.

4) Cross-cloud network security configuration

In a multi-cloud environment, security efforts focus is no longer limited to implementing controls around the perimeter of corporate assets, such as firewalls, but also on building security into assets themselves.

Challenges of multi-cloud practices

Cloud transformation is a long process, and there are many factors that influence strategic choices. It triggers discussions on enterprise data security,



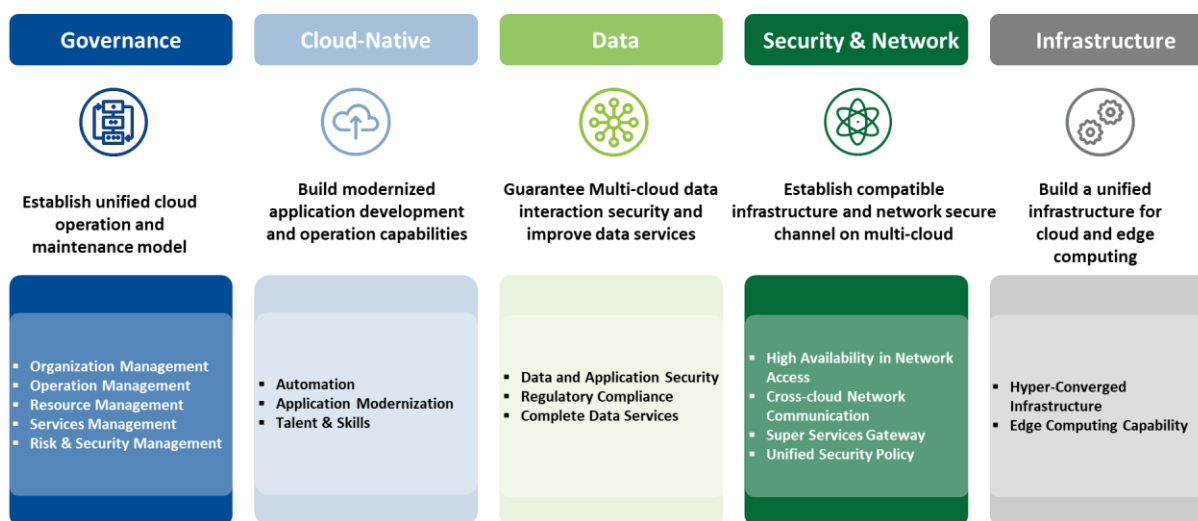
Source: Deloitte Consulting China

02 **Key Success Factors for Multi-Cloud Operations**

Chapter II Key Success Factors for Multi-Cloud Operations

Multi-cloud is a trend in the digital transformation of enterprises. Despite challenges such as complexity, security and talent shortage, companies and organizations are accelerating cloud adoption. Enterprises need to build a "cloud smart" model in a multi-cloud environment to achieve seamless integration and switching across multiple cloud services and realize cost optimization. Therefore, enterprises must have a unified operation and maintenance model for cloud management. That is, the development can be automatically deployed to the enterprise resource pool, whether a private or a public cloud. The future is multi-cloud integration, which also raises requirements on the system architecture. The application and resources should be decoupled to form a cloud-native architecture to support multi-cloud deployment.

To become cloud-smart, enterprises need to improve their capabilities in the following aspects:



Source: Deloitte Consulting China

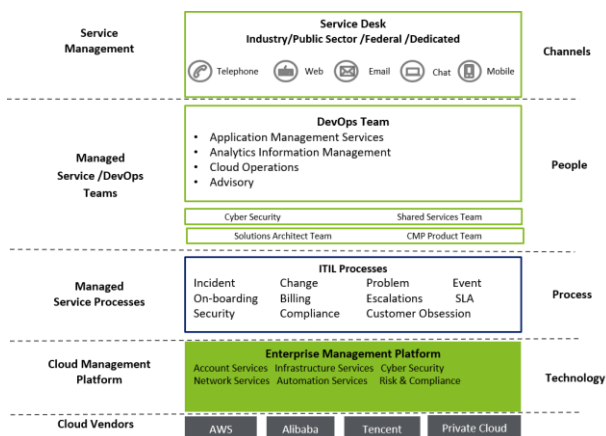
Section 1 Governance Level: Establish a unified cloud operation and maintenance model

Under the unification of multiple aspects of operations management, it is important to consider multi-cloud governance in terms of automation, performance optimization, efficiency, cost, and security.

1) Unified Organization Management

The operation of multi-cloud is a global work, and an effective organizational structure is a strong guarantee for the success of multi-cloud governance. It is necessary to establish a systematic organizational structure and clarify the division of responsibilities to achieve strategic goals. Enterprises should define and divide the responsibilities and authority of the governance, decision-making and executive levels according to their organizational structure and

resources. At the same time, a project collaboration system between organizations is formed to ensure that the information system can quickly collaborate and solve problems when deployed and run on the cloud.



Source: Deloitte Consulting China

2) Unified Operation Management

At present, most of the management tools on the market are fragmented. Unified cloud management platform should have the capabilities to unify public, private clouds and hybrid clouds access, management of heterogeneous resources, and monitoring of multi-cloud resource occupation and performance indicators.

According to the survey, 33% of respondents needed management capabilities such as performance monitoring and analysis¹⁵.

VMware Cloud Management experts believe that the unified management platform can maximize the value of the cloud through the following two dimensions:

- Multi-role: multiple departments and roles can be uniformly supervised: the security department can monitor the security risks, vulnerabilities, and action plans of business system applications; Business units can track cloud resources consumed in the business; Finance departments can understand enterprise cost allocation.
- Multi-scenario: Day 0: Cloud Service Design, Day 1: Automated deployment, Day 2: Intelligent Operation & Maintenance, Day N: Automated security compliance. After services go live, visualization dashboard and alerting systems can spot performance bottlenecks and failure points.

A unified Organization & Maintenance platform can support traditional and business diversification and make the solution highly available. From the management perspective, internal architecture is complex and needs to be connected with multiple platforms. Therefore, it is necessary to specify a comprehensive solution based on these characteristics to help enterprises establish their own cloud or deploy on the public cloud, manage across multi-cloud and realize multi-platform connections through the system architecture. While considering the existing ecology, architecture, and legacy issues of the enterprise, can help make a smooth migration transition.

3) Unified Resources Management

- Realize platform resource sharing through resource management such as cloud platform integration and inter-cloud connection. Performance, capacity, and application lifecycle management improve the utilization of idle resources to achieve efficiency standards.
- Resource requirements at each stage need to be defined based on implementation plan, including software and

hardware analysis facilities, participation of IT, data and business personnel, and the requirements for external suppliers.

- Emphasize the integration of resources and the improvement of professional depth, break the existing barriers of departments, and realize the sharing and flexible collocation of resources to better adapt to the future agile and flexible business model.

4) Unified Services Management

- At the service operation and management level, arrange Cloud resources and applications into cloud services, which can achieve cross-cloud deployment with the feature of Cloud Agnostic.
- Improve service lifecycle management processes, which include five stages: requirements and design, development and packaging, release and shelf, use and management, and change or removal. The management of cloud services requires attention to operability. Among them, the critical management links in the service life cycle are publishing, listing, upgrading or removing.

5) Unified Risk & Security Management

- Through the construction of a risk management system, the cloud platform is guaranteed to have the ability to avoid daily risks and deal with emergency incidents. Establish complete emergency handling policies, such as data backup, emergency handling, and disaster recovery approval processes. At the same time, it should have a relatively complete fault information release mechanism. When a business continuity fault occurs, it should have a comprehensive report of business continuity impact and service recovery, data recovery, and system recovery policies.
- Through the security management mechanism to realize the "two security" guarantee: cloud platform and information system security.

With the increasing importance and demand of multi-cloud governance, multi-cloud management products such as AWS hybrid cloud operating system, Ali Cloud hybrid cloud Apsara Stack, Jingdong Cloud hybrid cloud operating system Cloud ship, etc., emerge. The VMware Aria multi-cloud management portfolio, recently launched by VMware, provides enterprises with an end-to-end solution for managing the cost, performance, configuration, and delivery of their infrastructure and cloud-native applications. To avoid the state of "cloud

¹⁵ Statista, Most important capabilities to support multi cloud/hybrid cloud strategy in 2020, 202202

chaos" when enterprises rapidly move to the multi-cloud or super cloud era and obtain value from the cloud faster based on "cloud smart", VMware provides a package of solutions across private cloud, public cloud, and edge computing. More enterprises can have a unified infrastructure to manage existing enterprise-level applications intelligently, and even build new applications for data and artificial intelligence in the future.

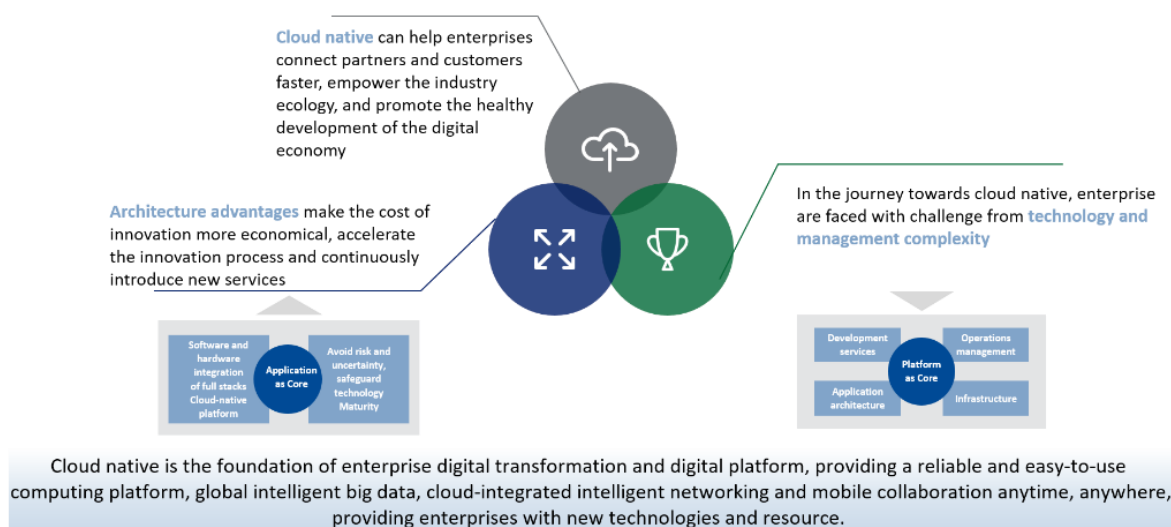


Section 2 Cloud Native Level: Build modern application development, delivery, and operation capabilities

Business needs are shifting, and the pace of technological development is accelerating. The capability to deliver applications more quickly while building a multi-cloud strategy is a necessary for modern enterprises to remain competitive while meeting customers' needs.

Build cloud-native applications, improve architecture elasticity, improve resource utilization, and reduce investment costs through architecture remodeling

Cloud computing accelerates enterprise innovation, digitalization, and the adoption of new cutting-edge technologies. The ability to relieve high risks, and to recover from pressure makes enterprises more resilient to face various complex situations and challenges.



Source: Deloitte Consulting China

Business users need to understand whether the current application is customer-facing, responsive to market changes, and compliant with industry standards. Different businesses have different performance and deployment requirements, and the key metric is whether developers can automatically deploy applications to the correct resource pools with maximum efficiency and minimum cost.

Some traditional architectures need to be optimized at the system architecture level if infra-up is an option, so as to match the cloud-native standards. In terms of the current market situation, some enterprises adopt cloud-native reconstruction, and others carry out transformation in small iterative ways. These two ways promote enterprises to build modern application development and operation and maintenance capabilities. The Forrester survey shows that in terms of global enterprise needs, cloud management needs have moved from the architecture layer to the development and platform layer and are beginning to build cloud-native capabilities into the platform¹⁶.

1) Automation

Implementing the DevSecOps operating model allows development, testing, and operations to work closely together, and provides the business with new digital and data analytics capabilities. An important step in maximizing the value of such work is to make the process as simple, transparent, and automated as possible.

With a goal to achieve efficient and consistent development, delivery, and operation and maintenance in a multi-cloud environment, the cloud-native DevSecOps upgrade path needs to be based on a complete toolchain and end-to-end open data, transition from manual deployment to instrumentalization, and then to the full-stack continuous automation, and on this basis achieve the overall service and business monitoring.

The development team can procure application resources and deployment and keep track of how the application

¹⁶ Forrester, Hybrid Cloud Management Software in China, Q3 2021

performs in production. The operations team can automate compliance and security monitoring of applications and maintain the health of the clusters and applications.

2) Application Modernization

Enterprises need to assess application requirements from all aspects to determine whether to modernize in the public cloud (with resilient, on-demand infrastructure and cloud-native development services) or on-premises (maintain control and optimize the use of existing infrastructure). The main application scenarios are as the followings:

o Platform-as-a-Service (PaaS) Kubernetes

In a multi-cloud environment, automatic deployment, scaling and maintenance capabilities of Kubernetes container clusters across public, private and hybrid clouds are particularly important. Enterprises deploying cloud-native applications on the Kubernetes infrastructure can quickly develop applications on Kubernetes through simple PaaS, improving developers' productivity by releasing them from day-to-day operations and enabling more time to focus on coding rather than infrastructure

o Micro-Services building

Micro-Services are containerized to quickly integrate new features and functions, enabling rapid iteration and change of discrete components of a system. Build a micro-service framework and container to support service decoupling and reuse, and meet the constantly changing needs of management and business. If there are many legacy systems which make it difficult to transform all the applications based on micro-services, replatform and rehost can be adopted first, and then carry out other transformation activities with the continuous improvement of maturity, namely the so-called "small step fast run".

In micro-service architecture, enterprises can provide services to users across multiple devices through API-first design principles, which can reduce integration difficulties, shorten product release time to respond to market changes quickly, and achieve digital transformation in an agile and lean way.

The application of a modern platform should consider dual-mode integration, that is, compatible with Legacy and modern container technology stack environments.

3) Talent & Skills

o Personnel skills transformation and upgrading

After going to the cloud, the organizational structure will change significantly, due to the reduction of infrastructure engineers. At the same time, there will be new demands in cloud development and services, such as security management personnel, architects, etc. Therefore, it is important to upgrade internal personnel skills and develop new cloud-oriented career directions.

o Build compound talents

For data-driven enterprises, cultivating compound talents is also a crucial part of success. Compound talents can process complex data, perform data analysis, visualization and data governance, and have keen business insights and valuable project management ability. Enterprises should establish their talent cultivation system, provide digital training and learning environment, empower employees and build compound ability.

In the cloud-native plane, cloud service providers are constantly innovating in response to the difficulties of enterprises and rapid market changes to help users navigate the cloud era. VMware's innovative VMware Tanzu solution, for example, enables companies to build and deploy cloud-native applications, increasing developer productivity throughout the Kubernetes journey to secure and modernize end-to-end, build-to-production and large-scale multi-cloud operations.



Section 3 Data level: Guarantee multi-cloud data interaction security and improve data services

Based on a wide range of data, Microsoft, Oracle, and Snowflake emphasize the visioning of super data, data cloud. Because users can use different data architectures, even traditional database vendors can only cover part of the picture. At present, the industry is generally moving towards the direction of data mesh; that is, data does not need to be aggregated, but exchanged at the nearest end. However, the data network is still in the concept stage, with few enterprises implementing it. Therefore, the focus is still on application transformation, that is, how to use different data technologies to ensure the infrastructure is comprehensive.

1) Data and Application Security

○ Data privacy

Customers have sovereignty over the content uploaded to the cloud and are responsible for configuring cloud storage, processing, and hosting. Without the customer's permission, the cloud platform will not access, use, or extract any data in the customer's uploaded content for any purpose, nor may it move or copy the customer's content outside the service area not selected by the customer. When managing multi-cloud platforms, a central management system and control platform should be adopted to define and implement consistent security deployment and configuration across multiple cloud platforms and have the ability to restrict data to specific cloud service regions.

○ Data integrity

Managing and maintaining data integrity helps disaster recovery. Data integrity can be verified at any time by algorithm-based verification, such as the Secure Hash Algorithm (SHA) or Cyclic Redundancy Check (CRC) provided by the S3 storage service provided by AWS.

2) Regulatory Compliance

China's current cyberspace governance strategy mainly focuses on the following aspects: international security, cyber security, data security and privacy protection.

Cyber Security Law, Data Security Law and Personal Information Protection Law of the People's Republic of China jointly regulate network and data security, and their core requirements are as follows:

○ Privacy protection

Personal information processors may only process sensitive personal information when they have a specific purpose and there are sufficient grounds for doing so. In addition to legal bases such as performance of contracts, personal information processors are required to obtain the "separate consent" on various occasions. Personal information processors should provide individuals with details of personal information processing, rights and measures to restrict or refuse processing, etc.

○ Localization and cross-border data transfer

The amount of personal information processed reaches the threshold that processors shall store all personal information they collect and generate in China, when it is necessary to provide personal information to overseas institutions, it must comply with legal requirements.

○ Important data

Any data related to national security, economic development and public interest is defined as important data, and its processor should take specific measures, conduct regular risk assessments, and submit reports to administrative authorities to fulfill data protection responsibilities.

Divided into industries, companies also need to meet different legal and regulatory requirements:

- Financial Industry: When cross-border data is involved, it is necessary to refer to the Data Security Law to carry out self-inspection or declaration as required.
- Pharmaceutical Industry: The data generated by the pharmaceutical industry belongs to the category of "including nuclear facilities, chemical biology, national defence, military industry, population health and other fields data, large-scale engineering activities, marine environment and sensitive geographic information data" in Article 9 of the Personal Information and Important Data Exit Security Assessment Measures. Therefore, the cross-border data should be reported to the industry supervisor or regulatory authorities to conduct the security assessment.
- Telecommunications industry: According to the Notice of the General Office of the Ministry of Industry and Information Technology on Network Data Security Management in the Telecommunications and Internet Industries, enterprises should comprehensively assess network data security compliance.
- Political institutions: Government departments shall, by the provisions of laws and administrative regulations, establish and improve the data security management system, fulfill the responsibility of data security protection, and ensure the security of government data.

In this regard, enterprises can take the following actions in terms of legal compliance with data security:

- Organize personal information inventory and identify sensitive personal information, define sensitive information handling policies and rules, and localize important data
- Conduct the personal information security impact analysis to assess the need to address potential impacts by conducting a security assessment
- Identify and evaluate business scenarios that require user "separate consent", clarify the company's "consent" management policies and rules, and design and implement "consent" management solutions
- Conduct cross-border data transfer assessment. Need to sort out the necessity, legality and legitimacy of data exit, the attribute, type, scope, quantity and technical processing of outbound data, the possibility of security incidents, the guaranteed ability of technology and management system, etc., and evaluate the security protection ability, legal and political environment of the data receiver. Last but not least, complete data exit compliance rectification work.

3) Complete Data Services

○ Data migration

To address the technical challenges posed by data migration and portability, storage vendors have developed capabilities to move data between different storage platforms, and many cloud vendors support cross-cloud workloads and data transfer.

○ Data disaster preparation and recovery

In a multi-cloud scenario, data disaster preparedness and recovery are classified into three modes: on-premises cloud backup, cloud backup, and cross-region backup.

On-premises cloud backup:

To regularly back up data such as server local files, NAS files, VMware VMS, and databases to object storage on the cloud. The benefits is not limited on the number of clients and storage capacity, on-demand subscriptions, or expansions. At the same time, it provides 12 9 data reliability, with encryption and data deduplication functions. Depending on the backup date, can selectively move cloud data from the hot access layer to the warm or cold access layer, which is simple, easy and fast to use. As the data depreciates, it can be automatically adjusted to a cooler access layer to save costs.

Cloud backup:

Can back up data on the cloud from file directories on virtual machines on the cloud, MySQL, Oracle, SQL Server, SAP

HANA, and NAS. It can efficiently back up data from other cloud platforms to the backup database through the Intranet, providing the real-time backup function when the RPO of MySQL and Oracle databases is close to 0.

Cross-region backup:

The mirror backup library provides cross-region backup, multiple protections for data, and high-performance cross-region disaster recovery of minute-level RPO and RTO.

Performing disaster recovery management can reduce the burden on IT administrators and improve operation and maintenance efficiency. In addition, with other products, users are equipped with data visualization, analysis, and indexing capabilities.

At the same time, enterprises need to identify and manage key data, such as ensuring that data is always accessible and managing data across cloud services. Users in different industries, such as education, healthcare, and e-commerce, have different requirements for data backup. Therefore, data security and compliance should be fully considered when backing up data between data centers and heterogeneous public clouds.

For disaster recovery drill tests, it is necessary to verify the availability and effectiveness of the established disaster recovery system at different levels and in various depths in a progressive way, from paper theory to actual operation, from business simulation to actual business participation. The drill test results can be used to revise, supplement and improve the disaster recovery plan, and provide theoretical basis and data index for the upgrade and construction of disaster recovery system. Enterprises can have evidence to rely on the construction of information system disaster recovery, and ensure that the completed disaster recovery system can fully achieve the goal.

VMware has launched products such as Gemfire and Greenplum to help companies address opportunities and challenges at the data level. The GemFire memory database is suitable for new applications requiring real-time access to data and high concurrency. By using GemFire to manage memory data, users can save costs related to high database transactions caused by CPU cycle, network traffic, and database access delay of traditional databases. Greenplum focuses on cloud-native data warehousing, the world's first commercially available X86-based, open-source, high-performance MPP databases with a mission to address the changing landscape of big data analytics in a cost-effective and easy-to-use manner. Because the product is lightweight and powerful enough, many large IT companies are using the Greenplum open-source version.

Section 4: Security and network level: Establish a compatible infrastructure, multi-cloud Internet security channel

In the cloud world, gaining the ability to accelerate innovation and take control of cyber security is critical for companies. Cloud networking solutions can provide users with an end-to-end and fully functional stack of network protocols from Layer 2 to Layer 7 (data link, network, transport, session, presentation, application), supported by the integration of declarative API with IaC (Infrastructure as Code) tools and low code paths for automation. Integrated security and network connectivity across cloud platforms can help protect an enterprise's critical applications, data, and infrastructure without affecting performance.

1) High Availability in Network Access

To prevent data loss and minimize cluster downtime in the event of a service interruption, users can deploy applications in multiple availability zones, and use load balances to distribute traffic on-demand. By distributing traffic to different back-end services, the service throughput capacity is expanded, and the single point of failure in the system is eliminated to improve the availability of the application system.

Cluster services typically provide a unique virtual IP address (VIP) externally to address fault tolerance and high availability. Client API/UI access to the cluster is usually directed to the primary node. In addition, if the primary node with the virtual IP address fails, the cluster selects a new primary node and modifies the mapping between the virtual IP address and MAC address. All the new traffic is automatically directed to the new primary node, implementing the primary/secondary switchover.

According to the current market demand of enterprises, cloud service providers have designed and innovated a series of solutions to provide support. VMware as an example, has launched VMware NSX Advanced Load Balancer (Avi) which provides functions such as multi-cloud load balancer, Web application firewall (WAF), and in-container load balancer to help enterprises implement network plane architecture and security.

2) Cross-cloud Network Communication

In a multi-cloud or hybrid cloud environment, enterprises need to focus on network connection and security, build high-speed, reliable, intelligent and secure network communication. In SD-WAN scenarios, capabilities such as cloud-native integration, seamless migration, and flexible

deployment simplify SD-WAN in hybrid and multi-cloud scenarios and facilitate cloud collaboration among enterprises.

3) Super Service Gateway

The multi-cloud environment usually adopts the cloud-native architecture, and different types of front-end services, such as mobile clients, web clients, and third-party applications, will be integrated with the back-end services. The back-end service supports different protocols, such as SOAP+XML, REST+HTTP, JMS, AMQP, and WebSocket. The front-end service can interact with multiple back-end services through the super service gateway. An API gateway is added between the front and the back end to minimize the number of requests to the back-end service while addressing the security of the service requests.

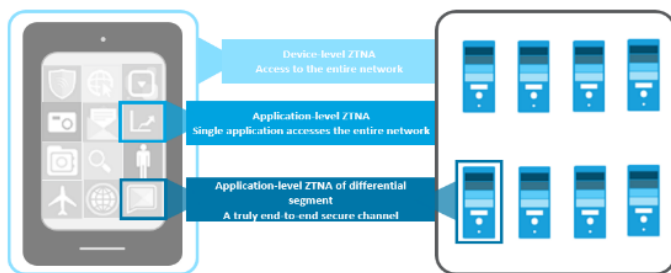
As a key link for accessing back-end services, data, business logic, or functions, API gateways redirect external traffic requests to the appropriate back-end services after all external access traffic has passed through. Its capabilities also include traffic management, policy enforcement or data transformation, authorization and access control, traffic limiting, monitoring, and API versioning.

The advantage of using the API gateway pattern is that the client does not need to make any configuration updates regardless of how the back-end services are refactored and migrated.

○ Application-level Zero Trust architecture solutions

With the deepening of enterprises' digital transformation and the advent of the post-pandemic era, remote access has become normal. Enterprises need to open more businesses to all kinds of personnel and devices for access anytime and anywhere. Multiple types of remote access scenarios produce many complex access requirements, intensifying the opening and extension of enterprise networks and making the network boundary more blurred. The existing border security products, mainly based on VPN access, need to improve in the port opening, multi-dimensional authentication, fine-grained permissions and self-security protection, which are difficult to cope with security challenges. Therefore, the zero-trust architecture solution is positioned as an alternative to VPN.

Zero Trust Network Access



Source: Deloitte Consulting China

4) Unified Security Policies

Enterprises need to deploy a unified security management platform to provide a unified network security console to manage resources in on-premises data centers and the cloud. The integrated visualization capability can cover all attack planes to achieve the consistency of management capabilities and security situation awareness between the centralized cross-cloud platform and on-premises data centers and improve the efficiency of security response through pipeline-oriented operations.

At the same time, enterprises need to reduce cloud security risks by detecting and preventing external threats, preventing intrusion attacks, and preventing virus infections. By implementing strict security policies, detecting C&C feature communication, protecting data leakage, protecting data from vulnerability attacks, and controlling enterprise cloud security compliance; Fine-grained control is implemented to protect against internal threats, prevent threats from spreading horizontally, and ensure east-west traffic security.

Section 5 Infrastructure Level: Build a unified infrastructure for cloud and edge computing

In China, with the rapid economic development and continuous maturity of emerging technologies, many industries and enterprises have accelerated the speed of digital transformation. These enterprises have developed a series of cloud-based solutions with industry-specific attributes by collaborating with cloud manufacturers, professional consulting service organizations, software service providers and system integrators on the cloud platform as the technology base. Vertical domain-oriented cloud platform, industry integrated supply chain platform, industrial Internet platform, big data center, etc., need to use cloud and edge computing infrastructure to ensure the continuity, availability and security of various platforms, as

far as possible to reduce the total cost of ownership and to expand business operations.

1) Hyper-Convergence Infrastructure

The rapid growth of digital businesses has prompted companies worldwide to embrace computing virtualization, which has transformed data centers over the past decade. However, many IT teams still rely on hardware-centric storage and network connectivity approaches, which are expensive, time-consuming to manage and maintain, and do not provide the flexibility and agility needed.

According to VMware research, 580 million modern workloads are expected to run in a diverse distributed environment including public, on-premises, edge computing, telecom and hosted clouds by 2024¹⁷. Companies want to be able to match their diverse portfolio of enterprise applications to the most desirable environment based on technical, business, or strategic needs at a low total cost of ownership (TCO). This has prompted enterprises to embrace multiple public clouds while continuing to invest in local environments and deploy services on the edge computing. Based on this, enterprises need to have an infrastructure solution that can be supported by both cloud and edge computing to better operate, scale, and protect various workloads in private cloud, public cloud, and edge computing. Digital business needs a new approach to infrastructure, and hyper-converged infrastructure can help enterprises achieve this goal.

Hyper-Converged Infrastructure (HCI) is an infrastructure that consolidates computing, management, and storage resources into industry-standard x86 servers to create software-defined data centers through building blocks. Hyper-converged infrastructures help ease the transition from physical storage solutions to virtualized storage and quickly achieve significant improvements.

VMware vSphere 8 and VMware vSAN 8 help enterprises run a variety of workloads in the environment of their choice. By innovating these common building blocks for private clouds, public clouds, and edge computing, enterprises will greatly improve the way they run, manage, and secure their enterprise applications, providing a unified infrastructure with value-added capabilities.

2) Edge Computing Capability

Edge computing refers to processing, analysing, and storing data closer to where the data is generated, enabling fast and near-real-time analysis and response. Edge computing can

¹⁷ VMware internal analysis, 202110

help reduce data processing latency, improve response speed, and enable better network traffic management while complying with security and privacy jurisdiction requirements.

Edge computing is the next evolution in distributed digital enterprises and the fastest-growing segment of workloads. IDC expects global spending in the sector to reach \$176 billion in 2022¹⁸. By 2023, it is expected that 70% of enterprises will perform data processing using edge computing¹⁹. Developed from decades of instrumentation, automation and connectivity technologies, the smart edge computing is maturing and evolving into a series of revolutionary technological capabilities that are transforming some of the world's largest technology and communications companies. Telecom companies deploying smart edge computing for 5G networks and super-scale cloud service providers optimizing their infrastructure and service offerings are all major drivers of this growth. Enterprises need the ability to run, manage, and better protect edge computing native applications in multiple clouds on both the near and far edge computing -- a suite of cloud-to-edge computing solutions that address the required use cases.

In VMware Explore 2022, VMware will launch a new enhanced Edge Computing solution designed specifically for edge computing native applications and to meet their performance, autonomy and latency requirements, including a fully integrated edge computing platform, VMware Edge Compute Stack 2, it can run modern, existing, and future edge computing native applications to help businesses meet the simplicity and scale requirements of the edge computing. In addition, this release will provide higher performance by supporting GPU pass-through for AI/machine learning applications. New features in VMware Tanzu Kubernetes Grid 2.0 will support both features, while enabling simplicity and scalability at the enterprise edge computing.



¹⁸ IDC, Worldwide Edge Spending Guide, 202201

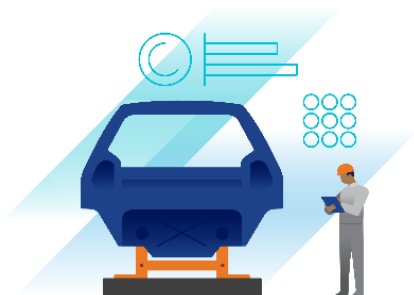
¹⁹ Intel, The edge outlook, 202111

03

Case Study

Chapter III Case Study

Case 1: Intelligent cloud platform blueprint design and implementation for an automotive company



Background:

An automotive company was faced with challenges such as uneasily-obtained scattered data, high personnel and maintenance costs, and slow response to demand. The company hoped to develop a solution with sufficient agility to build an agile delivery system through the continuous construction and improvement of the intelligent cloud computing platform, achieve cost reduction and efficiency increase, continuous innovation, and risk pre-control, fully support the implementation of digital transformation, and comply with privacy and security regulations.

Approach:

- Enable "everything as a service" by intelligently connecting infrastructure, applications, data and business processes
- Manage multiple clouds and vendors in a seamless, automated, and centralized manner. Users can seamlessly migrate, manipulate, and govern applications and workloads between public and private clouds, and even exchange data and information between different clouds
- Deliver agile and intelligent cost management services that leverage the benefits of cloud computing, supply at an on-demand scale, reduce capital expenditures, pay as you go, and achieve flexibility and affordability
- Use real-time perception and full connection to obtain data, and identify risk in advance based on data-driven approach. From the technical risk, compliance risk and security risk of cloud computing, a comprehensive cloud computing risk management and control mechanism is proposed

Achievement:

- Reduce labor and maintenance costs, reduce repetitive transactional work, and increase business innovation and digital transformation investment

- Build a user-friendly and agile innovation technology environment, and continuously introduce and integrate new technologies to enhance cloud computing innovation capabilities and form an innovative technology engine
- Provides a collaborative sharing environment in terms of resources, technology, and data, and enhances innovation capabilities by leveraging the advantages of the cloud platform
- Integrate data between systems, conduct in-depth analysis, and use visual information display to support decision support
- Minimize risk with enterprise-wide management and governance, avoiding incidents such as service unavailability, data loss, and information leakage

Case 2: Cloud-native digital marketing platform for a retail company



Background:

A retail company had an outdated marketing model and was unable to focus on the needs of target consumers quickly and accurately at all stages and channels. The company hoped to deconstruct the original core business system and build a new digital marketing platform through cloud-native technology, to enhance interaction with consumers, improve consumers' lifetime value, and realize consumer-centric digital transformation.

Approach:

- Through the service interface mapping of each interconnection system, it is unified into the service configuration of Spring Cloud for management
- Access basic services such as JDBC, JMS, etc., through standard protocols
- On the front end of the application, establish a mobile API access service. Set up Zuul Service Gateway on the application backend, including Spring Cloud Protection & Monitoring - Fault Tolerance Protection and Cluster Monitoring, and Spring Cloud Configuration & Governance - Service Configuration and Service Center
- In terms of technical services, database services, cache services, storage services, log services, message

services, service orchestration, rule configuration, configuration management, etc., are established

Achievement:

- Through segmented operation strategies, improve consumer conversion rates, to achieve refined operation and improve the efficiency of consumers
- Based on the empowerment of partners, build an enterprise consumer business and data platform, and move from refined traffic operation to marketing automation and intelligent system

Case 3: Multi-cloud management solution for a large container company



Background:

Customers wanted to migrate their applications separately to multiple clouds in the country and achieved 24/7 platform monitoring, local and cloud data center management, and multi-cloud cost management and optimization through standardized IT operational processes and maintenance models.

Approach:

- Designed a hybrid infrastructure strategy using AWS, Azure, and VMware
- Built Bare Metal-based virtualization platform based on VMware, and combined storage technology and database to achieve HA and DR To meet the RTO and RPO goals of applications
- Designed solutions to build EC2 instances on dedicated hosts to support MS SQL and Windows licenses and meet their cost-effectiveness requirements
- Provided regular multi-cloud cost optimization, tagging and integration billing services to achieve multi-cloud cost management
- Established standardized ITIL operations management processes to handle incidents, changes, and issue management

Achievement:

- Hybrid cloud deployments use a single IT operation mode for container workloads - improve business

agility, cut costs, and reduce risk wherever applications are deployed

- Improve system availability and restore systems on AWS in minutes

With AWS EBS Snapshots and S3, storage efficiency is increased by 40%, eliminating the need for large-scale storage for customers in the next 1 – 3 years, thus saving time to manage storage systems and further reducing operating costs. There is no need to prepare multiple sets of servers for disaster recovery, which saves operating costs for customers

Case 4: Secure and agile cloud deployment system built for a financial enterprise



Background:

The customer's existing traditional MPLS network was expensive and inflexible, and the ability to deploy new sites was limited due to transport availability. With industry requirements that all proprietary network traffic be encrypted, customers were looking for more secure and optimized cloud computing deployments.

Approach:

- Used VMware SD-WAN platform, which encrypts traffic and optimizes and protects connections to cloud computing services
- Secured data connections with VeloCloud's robust protocols and built-in firewall capabilities
- VMware SD-WAN Edge used its dynamic multi-pathing optimization (DMPO) to optimize and aggregate bandwidth connections to improve all network traffic transmission. It also provided a cost-effective alternative that allows each site to use two bandwidth connections of any quality. Failover from one location to another in an intelligent manner in the event of a failure ensured continuity of service without interruption
- By using the VMware SD-WAN Orchestrator, rules can be set to prioritize network traffic, ensuring that the most important traffic is always transferred

Achievement:

- Protects existing infrastructure investments during migration
- New sites can be deployed anywhere, anytime
- Significantly optimized bandwidth to support video, voice and data without compromising quality
- Compared with the existing infrastructure cost saving, low cost of redundancy to achieve the business continuity
- Encrypt all proprietary network traffic and build secure and optimized connectivity to cloud computing services for network visibility and control

Case 5: Hybrid cloud solution for a logistics company

**Background:**

As the competition between logistics companies becomes increasingly fierce, the original IT systems of customers didn't meet the needs of business departments and keep up with the super-fast technological improvement of competitors. The client sought to innovate faster and established a hybrid cloud strategy to lead the enterprise into the future, keeping pace with the pace of development in the global market.

Approach:

- Through VMware's hybrid Cloud platform, VMware Cloud Foundation, multiple data centers in multiple regions and availability zones were connected, and various cloud service providers were interoperable to support private clouds, public clouds and edge computing environments
- Used VMware vSphere® for optimal virtualization of its infrastructure, storage, and network connectivity layers
- Extended existing investments in vSphere through a hybrid cloud base to support existing virtual machines and future container workloads
- Replaced the network tunnel with VMware SD-WAN™ by VeloCloud® to securely connect the edge computing environment to the rest of the cloud network

- Through VMware Validated Design achieved automation and lifecycle management to create an integrated application deployment

Achievement

- With deployment in a private cloud fully automated, infrastructure setup time was reduced from six months to three weeks
- Reduced virtual machine provisioning time from six weeks to two minutes, enabling an integrated and automated development process
- The density of more than 65,000 VMS increased from 25:1 to 40:1, reducing server O&M overhead by two-thirds
- The new hybrid cloud platform serves all of the enterprise's co-located and data center sites, and supports any public cloud deployment across the network

Case 6: Hybrid cloud solution for a natural gas company built

**Background:**

The IT infrastructure of the company's internal master data center contains a large amount of redundancy. Different hardware platforms create complexity, reduce O&M efficiency, increase costs, and the existing infrastructure cannot support the planned user expansion. The customer seeks to establish a hybrid cloud strategy to improve operational efficiency, reduce complexity, and ensure compliance.

Approach:

- VMware Cloud Foundation hybrid cloud platform created a consistent infrastructure layer based on different hardware platforms, virtualized the computing, storage and network connection layers, enabled customers to consolidate isolated IT environments, centrally managed computing, storage, and network connection functions, and performed comprehensive operations through a single management interface

- Modernized the IT infrastructure for scaling while maintaining active-active data centers and disaster recovery sites
- Extended the hyper-converged infrastructure beyond the core HCI components of computing and storage, leveraging NSX to add network virtualization to system-wide HCI, enhancing network security and scalability over a wide geographic coverage
- Installed vRealize Suite to support multi-tenant provisioning and infrastructure management in the enterprise

Achievement:

- Increased resource utilization by 80%
- Extended IT environments while reducing operations and maintenance overhead
- Shortened with self-service IT response time
- Increased visibility into your resources helps meet compliance requirements

04

Summary and Prospect

Chapter IV Summary and Prospect

Similar to IT technology, the development of the cloud is accompanied by digital transformation, and has experienced trials and exploration entering the era of comprehensive practice at current stage.

While enterprises are enjoying the agility and innovation brought by cloud services, there are a series of challenges and pain points that come with it. Most enterprises cannot simply abandon the system that has been running for many years and build an entirely new platform on the cloud, because this is a multi-cloud symbiotic market, where requirements and limitations of talent, technology, cost, compliance, security, environment, and other aspects need to be considered. We need to transform and build IT systems with multi-cloud visioning to support the sustainable development of the business.

Many enterprises will also face the choice of which cloud to adopt for optimal cost. For the multi-cloud governance model, it is difficult to use a static cost structure to deduce, and it is necessary to consider talent, business value, market opportunities and other aspects to make comprehensive and dynamic decisions. In the multi-cloud structure, whether it is a private cloud, a public cloud or an on-premises data center, the proportion needs to be dynamically allocated according to different enterprise strategies and comprehensive cost analysis.

It is foreseeable that multi-cloud will not be a temporary stage in the cloud development process. It will be a new normal of infrastructure services. Enterprises need to build their own cloud smart to ensure the integration of network, data, development and governance levels between clouds. VMware takes a multi-cloud perspective to help companies build their own cloud smart.



Barry Chen
President of VMware
Greater China

Barry Chen, President of VMware Greater China, also provided his insights and strategies when answering the questions of enterprises in the construction of cloud:

“VMware's development journey has advanced through three main stages: from virtualization to software defined data center (SDDC) and now to the third stage – multi-cloud management. VMware is the one and only organization that utilizes general IT architecture to transform customer data into a multi-cloud ecosystem, while achieving infrastructure management, operation visualization, and application modernization. The multi-cloud approach and framework has been adopted by various multinational enterprises while they emphasize on flexible, integratable, modifiable environment. VMware firstly defined VCF as an architecture design from a multi-cloud perspective. The advantage of public cloud service providers is vertical customization in their products and service systems, while the unique advantage of VMware is horizontal ecological construction. We have long-term strategic cooperation with domestic and foreign manufacturers such as storage, network, security, etc. For leading enterprises in China market, we hope to help them achieve digital transformation, provide them with the most advanced IT framework, and enable their business development and transformation. Moving from private cloud to public cloud, hybrid cloud, and multi cloud is a long journey. Multi-cloud support for enterprises is one of the core businesses of VMware. It can provide the most flexible enterprise level solutions while considering the upgrading of traditional enterprise data centers, so that the data center and cloud strategies are the most efficient while meeting the strategic objectives of ESG's sustainable development. VMware is confident to ensure the smoothest iteration of the enterprise and reserves future flexibility and sufficient stability to maximize user investment under the strategic framework of transformation.

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