The Function and Enlightenment of Cloud Network Convergence in Fighting against the New Crown Epidemic

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Abstract: Firstly, this paper describes the challenge of the new coronary pneumonia epidemic to the ability of information service support. Secondly, it analyzes the main problems and related concepts of cloud network convergence, and points out the new problems faced by cloud network converge. Thirdly, this paper summarizes the current status and significant characteristics of the construction and development of cloud network convergence, and points out the important role and performance of cloud network convergence in fighting the new crown epidemic through specific examples; Finally, it analyzes the risks of cloud network convergence and the countermeasures was proposed.

1. Introduction

In the fight against the epidemic, China's cloud-network convergence service guarantee system provides data collection, situational awareness, coordinated management, epidemic analysis, disease trends, medical resource guarantees, personnel movement control, and high-risk geographical distribution of diseases. It has provided strong intellectual ability support and provided a model for the construction and organization of our government’s comprehensive information service system.

2. Challenges brought by the new coronary pneumonia epidemic to information service capabilities

This new coronary pneumonia epidemic obstruction warfare requires more flexible, precise, efficient and robust information service systems: One is flexible adaptation. The coordination unit of this epidemic involves more than 300,000 medical workers in various military units of the whole country. How to use appropriate means to allow them to communicate smoothly, divide labor and collaborate, and interact accurately is a problem; The second is fast and accurate At present, the scale of netizens in my country is 854 million. Accurately locating the position, trajectory and speech of an individual from such a huge crowd is a great challenge to the efficiency of information processing and execution; The third is intensive and efficient, social media gives netizens the ability to organize and mobilize worldwide, and netizens who are concerned about fighting the epidemic can organize their own resources, but at the same time pose new challenges to the docking and coordination capabilities of relevant governance systems; The fourth is safety and stability, when protecting nearly one billion netizens and hundreds of thousands of staff members in combating the epidemic, how to ensure safe, stable and sustainable operation of the information service system is also a comprehensive test of equipment performance, system operation efficiency and the quality of personnel.
3. Development background of cloud network convergence

3.1. Problems solved by cloud-network convergence

With the advent of the 5G era, the amount of large-scale data has increased geometrically. These data are formed and accumulated in large-scale Internet of Things terminals, and are transmitted to cloud servers for data processing. After processing, they return to the terminal to guide the business. This series of actions will have an extremely high demand for hundreds of Gbps of network bandwidth. Not only will there be delays, but also need to face many problems such as weak ICT (Information and Communication Technology), low connection success rate, etc. Experience cannot be guaranteed. The existing Internet cloud service architecture obviously cannot meet the differentiated needs of large connections, low latency and high bandwidth [4].

The cost of ICT construction and maintenance is also a big obstacle. From the user's point of view,

1) The construction cost of ICT facilities is high, and the comprehensive informatization makes the construction and operation and maintenance costs of ICT facilities undertaken by users continue to increase;
2) The technical requirements for the construction of ICT facilities are high, and there are too many types of equipment and software for centralized data construction. It is required that informatized talents must be all-round talents;
3) The failure rate of ICT facility operation and maintenance is high, and there are many compatibility problems between different devices and different software. When a failure occurs, it is difficult to find the specific location of the failure. From the perspective of service providers and operators, 1) ICT system integration is difficult, equipment types continue to increase, and application software is constantly updated; 2) Small and medium-sized ICT projects cannot be supported. Operators and integrators do not have sufficient energy and income to support; 3) System operation and maintenance costs are high, operation and maintenance of ICT facilities projects are difficult, and efficiency is low.

3.2. Conceptual analysis of cloud-network convergence

At present, major telecom operators and service providers all have their own explanations on cloud network convergence, and there is no broad consensus on the concept of cloud network convergence. There are three types of proposals that are highly recognized in the industry:

Method 1 (China Telecom): Cloud network convergence is for the purpose of application. By integrating various software and hardware resources in a certain form, users can flexibly adjust according to their needs to achieve low consumption and high efficiency of virtual resources service [1].

Method 2 (China Unicom): Cloud network convergence is a technology that integrates cloud computing, artificial intelligence, big data, and communication networks, and has elements for vertical industry-specific applications, which is called cloud-network convergence [2].

Method 3 (China Information and Communication Research Institute): Cloud-network convergence is a profound change in the network architecture based on the parallel drive of business needs and technological innovation, which makes the cloud and the network highly collaborative, mutually supportive, and a model of reference for each other. At the same time, the bearer network is required to open network capabilities on demand according to various cloud service requirements, to achieve agile networking and on-demand interconnection between the network and the cloud, and to reflect the characteristics of intelligence, self-service, high speed, and flexibility [3].

China Telecom emphasizes resource virtualization, service orchestration and overall high efficiency. What China Unicom highlights is the agile adaptation of resource integration to vertical industries. They all meet the needs of users from the perspective of infrastructure providers. The difference is that China Telecom focuses on basic general services and China Unicom focuses on industry end support. The definition of China Information and Communication Research Institute is relatively comprehensive, and the definition is relatively clear. It proposes a low-level agile communication, cloud-network collaboration, open interconnection on demand, high-speed flexible adaptation of the middle layer, and intelligent and self-service on the top layer. There is a more complete definition, but
comparison academic, practical guidance is not strong.

3.3. New problems faced by cloud-network convergence

With the rapid development and popularization of big data, Internet of Things and artificial intelligence technologies, higher service requirements have been imposed on cloud computing. However, traditional network design, construction, and operation models have made cloud and network difficult to coordinate, and the network has become a cloud. The shortcomings of development have formed the problem of cloud, bottleneck between clouds and cloud edge coordination.

(1) The problem of bottleneck in the cloud. In 2012, as shown in Figure 1, 12306 users in Spring Festival had a huge amount of dynamic and interactive access, resulting in frequent website crashes, unable to log in, and unable to pay. In 2013, 12306 handed over part of the process, the "remaining ticket inquiry" business, to Alibaba Cloud to provide services, and adopted the cloud-end collaboration model to alleviate the problem of frequent downtime. By stripping the "Remaining Tickets Inquiry" out of the entire system for independent operations on the cloud, it directly saves 75% of the computing power consumption. The highest daily peak page views in the year reached 40 billion times, and in 2019 this number reached 160 billion times.

![Changes in Taobao transaction volume on November 11, 2012](image)

Figure 1 The problem of bottleneck in the cloud

(2) The bottleneck between clouds. Alipay users need to pay from the interface of Alipay and the bank after clicking to pay. The two belong to two different clouds. The connection between the clouds becomes a bottleneck, and can only support dozens to hundreds of transactions per second, and the stability is relatively poor. On Double Eleven in 2011, a few users were unable to pay during the peak period. After investigation, it was found that the online banking system of a few banks failed under pressure. In the Double Eleven in 2012, Alipay launched an activity to attract users to recharge first and then pay, allowing users to recharge their money to Alipay’s balance, and deduct money directly from the balance during transactions, so that the external bottleneck problem was transferred to Within the payment cloud, the peak transaction value of the year reached 19.1 billion RMB, as shown in Figure 2.
(3) The Problem of Cloud-side collaboration. With the continuous popularization of smart driving, smart factories, and smart communities, the integration of edge computing and cloud computing has gradually increased. However, the complexity of smart cars, ocean-going ships, CNC machine tools, and construction machinery equipment is high, and the information exchange protocol is not unified. The lack of a unified interface results in high cost of the cloud, long transformation period, and difficulty, high data processing difficulty, and low utilization rate, resulting in cloud-side collaboration becoming the bottleneck of the entire system.

4. The current situation and characteristics of cloud-network convergence construction
At present, providing dynamic, accurate, and scalable information services has become the foundation of the development of the information society, and providing high-quality, easy-to-share, and easy-to-use information services has become the general trend of contemporary social development. As the pace of business internetization continues to accelerate, cloud computing platforms will usher in concurrent avalanche-like access. The centralized data storage and processing mode will face intractable bottlenecks and pressures, and problems such as cache penetration, cache avalanches, and cache invalidation will appear.

4.1. Development status of cloud network convergence
At present, the main domestic cloud network convergence participants can be divided into three categories: telecom operators, service providers and equipment manufacturers. Telecom operators are represented by China Telecom, China Mobile and China Unicom, service providers are represented by Alibaba and Tencent, and equipment manufacturers are represented by Huawei, H3C and Yealink.

(1) Huawei and China Telecom. Huawei and China Telecom, relying on the advantages of "seven networks + two-level cloud" in terms of network quality, network scale, access conditions and diversity, provide a flexible combination of "cloud + multiple access", including public cloud, exclusive Cloud, private cloud and other cloud products, as well as multiple product portfolios such as IPRAN dedicated line, CN2 dedicated line, cloud gateway, and high-speed between clouds, combined with the characteristics of telecommunications cloud network to develop network functions, can build a resource can be globally scheduled, and the ability can be fully open, Cloud-based platform with flexible capacity expansion and flexible architecture adjustment [6].

(2) Alibaba. In 2018, the edge intelligent access gateway was released, and a cloud-network convergence service system integrating cloud-on-network, inter-cloud network, and cloud-on-cloud network has been built, which can realize the enterprise cloud business and network department in minutes [5]. By building the Feitian cloud operating system, providing VPC, NAT gateway, and load balancing services through the cloud network, providing the GEN cloud enterprise network, GA global acceleration service through the cloud network, providing high-speed channels, VPN gateways, and
smart connections through the cloud network into the gateway service.

(3) China Unicom. In 2018, seven new products including cloud networking, cloud networking, cloud dedicated line, cloud broadband, China Unicom cloud shield, video intelligent boutique network, and financial boutique network were released to provide cloud-network integration solutions. Unicom Cloud Shield is a DDoS unified protection platform based on the deployment of the entire network. The video intelligence boutique network is designed to deliver high-quality video transmission networks for real-time video transmission needs. The financial boutique network provides customers with exclusive high-bandwidth pipeline resources and a variety of protection methods.

(4) H3C. In 2015, it released its new generation UIS 6.0 unified infrastructure system, which integrates the lightweight version of Open Stack customized by H3C and H3C network technology to promote unified management, integrated delivery and operation and maintenance of the infrastructure platform. Solution-level converged architecture covering computing, storage, network and virtualization, as shown in Figure 3.

H3C UIS 6.0: multidimensional virtualization security architecture

(5) Tencent and Yealink. With the technical advantages of Tencent Cloud in the fields of cloud computing, artificial intelligence, big data, security, etc., Yealink Network can realize the interconnection and interoperability of smart terminals and Tencent Cloud platform. Tuning and flexible matching form a solution that meets the application needs of different scales, different industries, and different scenarios, as shown in Figure 4.
4.2. Capability characteristics of cloud-network convergence

The purpose of cloud-network convergence is to build a flexible network, provide one-stop, agile, flexible, on-demand, intelligent and other service capabilities [5], with the following five notable features:

(1) Intensive elasticity. Intensively constructed large-scale cloud-network converged data centers can save 5-10 times the unit operation and maintenance, power supply, and network costs of small and medium-sized data centers. Naturally supports multi-point networking and convenient expansion. Compared with traditional dedicated line networking, the number of customer lines drops from \(N(N-1)/2\) to \(N\). Cloud-network convergence can realize automatic control, intelligent control, automatic activation, network elastic bandwidth, and dynamic speed-up.

(2) Reduce costs. Cloud-network integration makes IT rent-for-use construction a reality, saving costs in software, equipment, construction, operation and maintenance, etc. The operation and maintenance model has changed from independent operation and maintenance of sub-projects to unified operation and maintenance, and single-product operation and maintenance to integrated operation. The transformation of maintenance can reduce the one-time IT investment by 90% and the comprehensive use cost by 30%, which obviously improves the operation and maintenance efficiency and reduces the operation and maintenance cost.

(3) Lightweight collaboration. Cloud-network convergence promotes the light-loading of application software. After the deployment of independent software is converted to cloud deployment, there is no need to build a special ICT environment and the recruitment of specialized operation and maintenance personnel, which solves the technical and cost difficulties of independently deploying IT systems. It solves the difficulty of IT system collaboration among enterprises and supports multi-party collaboration such as cloud-side collaboration, edge-side collaboration, and multilateral collaboration in the same application scenario.

(4) Stable and reliable. In the second half of 2018, major public clouds frequently failed, or services were down or data was lost, and even events that were destroyed by natural disasters occurred. The use of multiple public clouds, in addition to reducing the lock of public clouds on users, can also play a role in dispersing risks.

(5) Multidimensional security. Cloud-network convergence has a multi-dimensional security system with full network and cloud network integration. MPLS technology builds an independent routing table to ensure that different users' data cannot be accessed. At present, Alibaba has provided more than 1,000 enterprise customers with 99.95% availability and data durability 99.99995% trusted and reliable cloud service.

5. The prominent role of cloud-network convergence in the fight against the new crown epidemic

In the fight against the epidemic, the nationwide upper and lower information and communication service system was concentric and coordinated, and played an important role in network, data, system, and service, mainly in network, data, system, deployment, and service:

(1) Fast network adaptation. By setting up a hospital 4/5G wireless network and a dedicated line network, it took only 4 days to complete the construction and commissioning of the Vulcan Hill Hospital network and lines, and opened a medical insurance and health network for Vulcan Hill Hospital communication; based on Tianyi Cloud Deploying hospital information systems, including hospital HIS (Hospital Information System), PACS (Picture archiving and communication systems), RIS (Radiology information system) and other core systems, greatly shortened the construction cycle, completed the Raytheon Mountain Hospital in only 12 hours Information system deployment.

(2) The data is accurate and detailed. Through the "big data + grid" method, all regions accurately sorted out the data of vehicles, flights, and high-speed rail data from Wuhan to people everywhere. Academician Li Lanjuan, member of the Senior Expert Group of the National Health and Health Commission, said in an interview with CCTV on January 28 that experts are using big data technology to sort out the life trajectory of infected people, track the history of crowd contact, lock the source of infection and close contact with the crowd, for the prevention and control of the epidemic provide
valuable information.

(3) The system responds quickly. During the closure of Wuhan, the urban big data system quickly aggregated data from relevant units such as the public security department, education department, transportation department, housing construction department, etc., and grasped the relevant data of the entry of the source of the disease source, providing for the prevention of the spread of the epidemic and effective gridding prevention and control. Big data support. Tianyiyun cooperates with Shanghai Lianying Medical to provide Wuhan 5th Cabin Hospital with a "5G+Cloud+AI" new coronary pneumonia intelligent auxiliary analysis system. It uses deep learning algorithms to segment lung CT images, automatically generates reports for doctors, etc., from diagnosis to treatment. Throughout the process, the reading efficiency is improved by 93%.

(4) The deployment is agile and efficient. Cloud-network convergence makes rapid and agile deployment a reality. Many hospitals set up "online hot clinics" to provide online consultation and diagnosis and treatment services for fever patients, conduct online consultations, offline consultations, up-down interactions, and video connection authoritative experts, science Guide the treatment plan, make good use of medical resources and make full use of it, and make outstanding contributions to the control of the epidemic.

(5) High concurrency and reliable service. Cloud network convergence overcomes the resource crisis brought about by high concurrency. At 9 a.m. on February 4, based on the 5G network, CCTV launched the "24-hour epidemic" to conduct a full HD live broadcast of the construction of the two hospitals of Vulcan and Raytheon, while watching online users more than 80 million online, becoming the strongest cloud in history Supervisor lineup. During the epidemic, the demand for internal and external services such as remote conferences, online classrooms, online consultations, and live broadcasts broke out. Cloud-network fusion technology and RTC (real-time audio and video), artificial intelligence, 5G, and big data technologies jointly supported hundreds of millions of concurrent needs. The average daily call duration of Tencent's real-time audio and video TRTC exceeded 3 billion minutes, with peak calls and Lianmai concurrently reaching 10 million.

6. The enlightenment of the cloud network convergence to fight against the epidemic situation to our government

Facing the new crown epidemic situation, summarizing the experience in the application of information and communication construction, reflecting on the shortcomings and shortcomings, this is not only of great significance for the prevention and control of the epidemic situation, but also conducive to promoting the modernization of our government’s ability to build and manage the government. From the process of organizing the cloud-network integrated service in the fight against the new crown epidemic, we got the following enlightenment:

(1) In addition to reserve technology, reserve application. During the quarantine period, online micro-medical doctors, Dr. Lilac, Ping An Hao, and Dr. Chun Yu were welcomed. They all launched special consultation areas for new coronary pneumonia, and people can immediately consult and solve doubts. This is inseparable from the usual service reserves of popular platforms such as Tencent Medical Code and Ali Health. The military needs to reserve general public applications such as medical services, logistics, and communications in order to ensure that it can be used in a timely manner.

(2) In addition to mobilizing supplies, we must also mobilize services. UFIDA launched the "Youyun Cai" special procurement and supply cloud service to fight pneumonia, and established a supply service platform between medical supplies suppliers and medical institutions to help solve the supply and management of medical supplies in epidemic areas with technology. This reminds us that the government not only needs to pay attention to the mobilization of tangible materials such as hardware, software, and personnel, but also needs to pay attention to the mobilization of basic services such as cloud network integration, cloud computing, and edge computing.

(3) In addition to the tempering system, the model must be tempered. The management information system construction of Vulcan Hill Hospital received the task from January 24. It is planned that all
commissioning trials must be completed before the opening of the clinic on February 2. The project volume in the past 2 to 3 months, this time was high within 9 days The quality is completed. This is inseparable from the rich experience and business model accumulated by Donghua Medical for the software update of Beijing Xiaotangshan Hospital. This requires that the government should not only focus on updating the business system, but also pay attention to the pain points, difficulties, and blocking points of the business, and optimize the business model of each professional post.

(4) In addition to developing equipment, it is also necessary to build an ecology. During the outbreak battle, Huawei, China Telecom, China Unicom, China Mobile, China Tower, China Electronics, China Xinke and other front and rear companies spontaneously cooperated and coordinated operations based on the cloud-network fusion dynamic framework, and built a collection of information. Stable transmission, accurate positioning, trajectory tracking, situation display, to the epidemic situation traceability and analysis of the trend of the spread of the service ecosystem, provides the central epidemic work group to provide high-quality epidemic situation analysis, epidemic prevention and control deployment, etc. provides high-quality Big data decision support service.

7. Summary

With the deepening of cloud network convergence research and deployment, the collaboration between edge computing, cloud computing, and networks (especially wide area networks) has become a new research point [8]. The sudden increase in demand brought about by the epidemic has brought opportunities for centralized performance to a flexible, reliable, and intelligent cloud-network convergence service system, and cloud-network convergence services have also handed in qualified answers. The accumulation of technology, personnel and experience is directly related. However, there are some hidden concerns about cloud-network convergence. For example, the availability of cloud on the system, the reduction of user experience due to the concentration of resources, the rapid recovery of users from denial of service, and the imitation of counterfeiting by users due to virtualization require continuous and iterative research on the basic theories and key technologies of cloud-network convergence. It is used to provide a reliable and safe infrastructure for future artificial intelligence.

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