Overview of Cloud Computing Development

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Abstract: Cloud computing is the key "national infrastructure" to win the competition in the intelligent era. At present, the global cloud computing market is highly concentrated, showing a "3A" pattern, while China's cloud computing market is a "one superpower and many powers" pattern. This paper makes a comparative analysis of Alibaba Cloud and Amazon Web Service (AWS) from four aspects: overall strength, operating income and profit level, research investment and innovation capability, business model and policy environment. To promote the development of China's cloud computing industry, efforts should be made from four aspects: environment and security, technology and application, industry and ecology, and international exchange and cooperation.

1. Definition and impact of cloud computing

Based on different understandings, and people give various definitions and annotations to cloud computing. Generally speaking, cloud computing can be understood as the storage, processing and utilization of information and data by remote computers connected through the Internet [1]. This means that cloud computing users do not need to invest a lot of resources, and can obtain the desired, theoretically unlimited information and data requirements and run calculations through any computer connected to the Internet.

1.1. Definition and classification of cloud computing

From a professional point of view, cloud is a metaphor for the Internet. Cloud computing can be said to be the product of the continuous integration and development of traditional computers and contemporary Internet technologies, including but not limited to distributed computing, parallel computing, utility computing, network storage, virtualization, load balancing, hot backup redundancy and other specific technologies[2]. At the present stage, what is widely recognized is the definition given by the National Institute of Standards and Technology (NIST): Cloud computing is a pay-per-use model, which provides available, convenient and on-demand network access and access to configurable computing resource sharing pools (resources include networks, servers, storage, application software and services). These resources can be quickly provided with little management work or interaction with service providers[3]. However, with the rapid development of cloud computing industry in recent years, a new mode of time-based payment has emerged in cloud computing.

According to the different levels of different resources provided by cloud computing services, cloud computing can be divided into three categories: IaaS (infrastructure-as-a service), infrastructure as a service; PaaS (Platform-as-aService), platform as a service; SaaS(Software-as-a-Service), software as a service[4]. According to different service modes, cloud computing can be divided into three types: private cloud for internal service provision, public cloud for public use, and hybrid cloud combining the two[5].

1.2. Impact of cloud computing

In recent years, innovative technologies such as artificial intelligence have begun to be integrated into the field of cloud computing. With the gradual development of intelligent robots, intelligent homes, unmanned vehicles and intelligent cities, the integration of artificial intelligence and cloud

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has been deployed in multiple application scenarios in multiple industries. In 2017, a number of domestic cloud manufacturers including Tencent Cloud, Alibaba Cloud, Baidu Cloud, Kingsoft Cloud, Jingdong Cloud and others released their own in-depth learning platforms. At the same time, with the breakthrough progress of big data and artificial intelligence in recent years, the "artificial intelligence + big data + cloud computing" model known as "ABC" will play a decisive role in the development of enterprises, industries, the whole country and the world.

2. Development status and characteristics of global cloud computing industry

At present, the global cloud computing market is highly concentrated. Starting from 2016, Amazon Web Service (AWS), Microsoft Cloud (Azure) and Alibaba Cloud form the first camp in the global cloud computing market, and the "3A" pattern of the cloud computing market is emerging.

2.1. Global Cloud Computing Market Scale and Development Trend

The global cloud computing market will grow steadily in 2016 with a total market size of 52.24 billion US dollars, up from 2015 to 25.36%. In terms of market segments, IaaS market contributed 22.221 billion US dollars and maintained steady growth. PaaS market contributed less than 5.435 billion US dollars, the growth rate slowed down, but database services and business intelligence platform services grew faster. SaaS market contributes up to nearly 40 billion yuan and is the largest component of the global public cloud market[6]. In the interim, Amazon is an obvious leader in the public cloud market. Its 44.2% market share determines its absolute market dominance, which is far higher than that of Microsoft, Alibaba and Google combined.

2.2. New Features of Global Cloud Computing Development

2.2.1. "Cloud +AI" Becomes New Trend. Cloud computing is data processing

In the natural soil, large-scale parallel and distributed computing capability can help reduce the computational cost of AI (Artificial Intelligence). At present, AI, as a powerful weapon to improve the efficiency of data processing, has become a market that cloud computing manufacturers are bound to win. Industry giants such as Google, Amazon and IBM have all set up special departments to join the "war" in the field of artificial intelligence. The integration of “Cloud and AI”has become a new trend.

2.2.2. Private cloud market is booming.

Traditional IT vendors and technology innovation enterprises have gathered together to form a crowdfunding development situation for private clouds. They are striving to compete with Amazon, Google, Microsoft and other cloud service industry giants in the cloud computing market competition with the help of open source communities and platforms. At present, they have become another core development trend in the cloud computing industry ecology.

2.2.3. Potential threats to cloud security.

The existence of "cloud" enables massive data resources to be scaled and centralized. Once physical facilities such as data centers and network lines are artificially destroyed or natural faults occur, it will have an immeasurable impact on cloud security. This is undoubtedly a very difficult challenge to the operation and maintenance level of cloud service providers.

3. Development status and characteristics of China's cloud computing industry

At present, China's cloud computing market share is in a "one superpower and many powers" pattern. Alibaba Cloud continues to maintain its leading position in the market, with its market share in 2017 further increasing to 45.5% compared with 2016. Tencent Cloud is firmly in second place with a market share exceeding 10%. China Telecom ranked third, up about 51% year on year. Kingsoft Cloud, ranked fourth, achieved a year-on-year increase of 82%[7]. AWS grew

strongly, entering the top five IaaS markets for the first time.

3.1. China's cloud computing market size and development trend

In the past five years, the domestic public cloud market has maintained a rapid growth trend, with the overall size of the domestic market exceeding 15 billion yuan in 2016. Among them, the IaaS market grew rapidly, surpassing SaaS market for the first time in scale to 8.74 billion yuan, up 108.1% from 2015. At present, IaaS services have been fully recognized by domestic enterprise users. PaaS has a small market share and is in a critical period of expanding the market window. It is loved by early start-up companies for its advantages of low cost and fast and flexible operation. Although SaaS market performance is not as dazzling as IaaS market, its scale still accounts for a large part of the domestic public cloud market and its growth rate is 34%[8]. The deficiency lies in the fact that international vendors occupy the main share in the core field of SaaS market, and there is no strong leader among domestic vendors. This will be an important obstacle to the further development of the domestic SaaS market.

3.2. New features of domestic cloud computing development

3.2.1. Cloud computing manufacturers are accelerating overseas expansion.

With the accelerating internationalization of Chinese enterprises and the growing "cake" of the global cloud computing market, most domestic cloud computing manufacturers are no longer satisfied with the fixed demands of the domestic market, but focus on promoting the internationalization strategy, actively expanding overseas customers and continuously building overseas infrastructure. Tencent Cloud has already established 15 data centers and data nodes in the world, and with 16 data centers in China, its global service nodes will reach 31, making it the most extensive Internet cloud service provider in China with the world's cloud computing infrastructure.

3.2.2. Cloud computing applications began to penetrate into traditional industries.

At present, the application of cloud computing in China has covered all aspects of the internal Internet industry including games, e-commerce and social networking, as well as government affairs and traditional producer services with government and finance as the primary breakthrough points[9]. As early as 2013, the Information Promotion Department of the Ministry of Industry and Information Technology carried out a series of work such as top-level design, standard development and pilot demonstration of the "cloud-based e-government public platform". On the one hand, it is conducive to accelerating the transformation of e-government development mode; on the other hand, it can give full play to the basic supporting role of cloud computing in e-government construction.

4. Comparison of representative enterprises at home and abroad: A comparative analysis of Alibaba Cloud and Amazon Web Services

This paper selects Alibaba Cloud under Alibaba and Amazon Web Service (AWS) under Amazon to make a comparative analysis.

4.1. Overall Strength Analysis

The overall strength analysis part compares the two companies from three perspectives: their international status and influence, market and user demand, global layout and service coverage capacity, with a view to reaching an all-round and comprehensive conclusion. One is to compare the international status and influence angle, and discuss the issue based on the IaaS magic quadrant of the global cloud computing industry in 2017 published by Gartner (as shown in Figure 1)

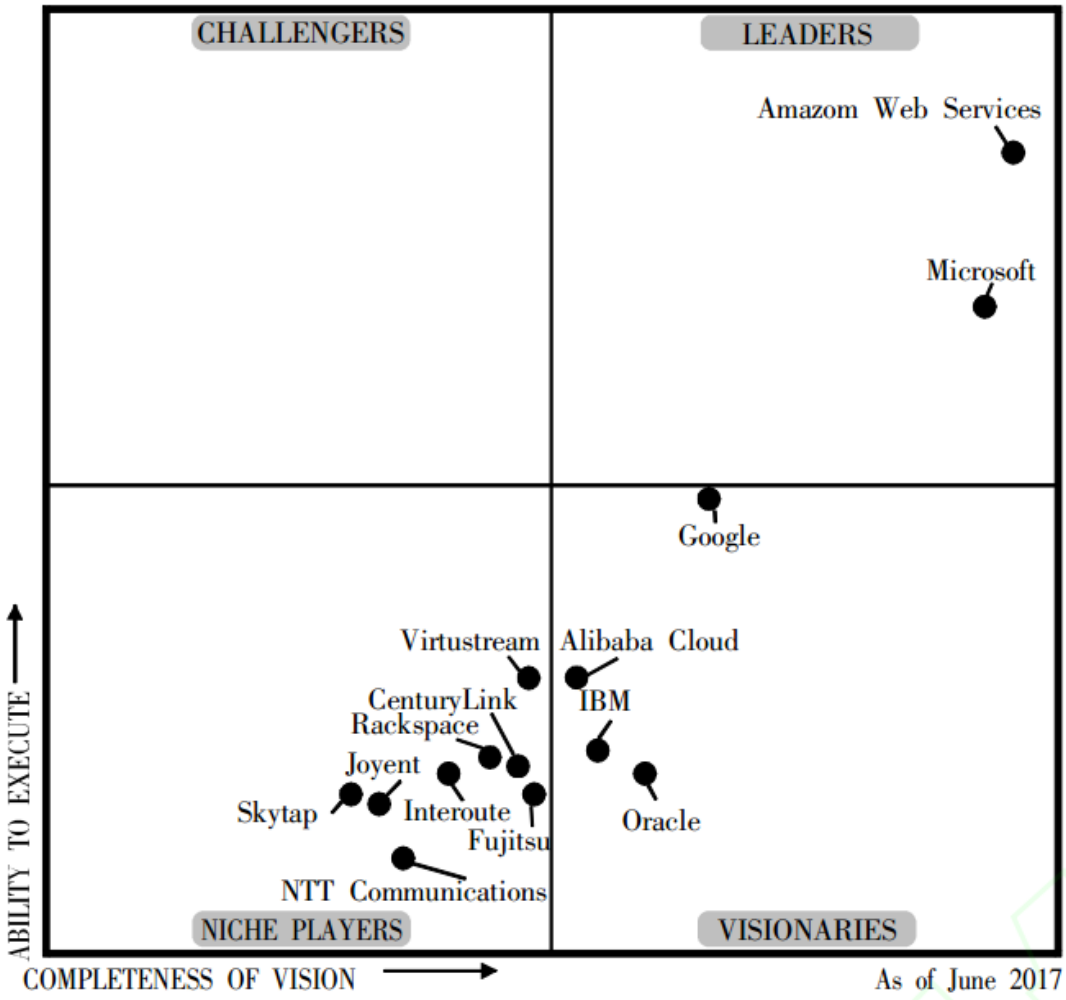

Figure 1 IaaS Magic Quadrant of Global Cloud Computing Industry in 2017

(Source: Gartner, Global Public Cloud Market Share Report 2016.)

AWS, unsurprisingly, continues to lead the global cloud computing industry. AWS, which accounts for more than 40% of the global cloud computing market, is an absolute leader. With its strong innovation ability, extremely high agility, the most extensive use scenarios and the most abundant application cases, AWS has won the top spot in the increasingly competitive cloud computing field for several years. Alibaba Cloud is even more surprising, becoming the fourth place in this core field after AWS, Microsoft and Google. It is also the first time that a Chinese cloud computing manufacturer has entered Gartner's magic quadrant. Although Alibaba Cloud accounts for less than 4% of the global market and still lags far behind AWS in terms of magic quadrant[10], Alibaba Cloud, which is also based on e-commerce, has more room for growth in the future than Microsoft, which is positioned in the cloud of office software, SaaS-focused products, and Google, which is technically strong but commercially weak.

AWS has been in operation since 2006 and has changed from loss and profit-loss balance to profit in less than 8 years. The reason can be attributed to the scale effect, the contribution of intermediate products such as databases and the construction of market platform. Alibaba Cloud was founded in 2009 and suffered serious losses in 2015 (the annual report data show that the profit margin before interest, tax, depreciation and amortization is lower than-70%). The losses did not improve significantly until 2016 and the first half of 2017. It is predicted that Alibaba Cloud will make profits in a short time in the future. It took eight years to complete this journey. From this, it can be concluded that the upfront investment cost for the construction of a public cloud leading platform with scale effect and profitability is huge, including infrastructure construction and annual depreciation and maintenance costs, user habit cultivation and response to price war that may break

out at any time, research and development expenditures, ecological cultivation costs, etc. Even logically speaking, sustained investment and enduring losses are the only way for cloud computing enterprises to succeed.

4.2. R & D investment and innovation capability

One of the important indicators to judge the technical strength of the two enterprises is the amount of research and development investment. Neither Ali nor Amazon disclosed the specific value of R & D investment in the cloud computing market segment. Therefore, assuming that the enterprise's investment in cloud is proportional to the total investment, we chose to replace the analysis with the group's total R & D investment. In 2016, Amazon's total R & D investment reached 16.1 billion US dollars, ranking first in the world's major scientific and technological enterprises. Comparatively speaking, although Ali has promised to spend no less than 100 billion yuan (about 15 billion U.S. dollars) on research and development in the next three years, the average annual total of 5 billion U.S. dollars is still less than 1/3 of Amazon's, while the 2.5 billion U.S. dollars spent on research and development in 2016 is less than 1/6 of Amazon's. Alibaba Cloud should make up for the shortage of research and development investment as soon as possible to enhance its core competitiveness.

5. Further promote the development of China's cloud computing industry

To further promote the development of China's cloud computing industry, we need to adhere to the concept of "tolerance and prudence", that is, to open our eyes and accommodate differences. Respect the new momentum and stick to the bottom line. Strive to create a good policy environment for the development of cloud computing industry.

From the perspective of environment and security, we suggest the following points: 1) Actively create a macro environment to support the development of cloud computing; 2) Improve the cloud computing security system; 3) Increase fiscal and tax support and investment and financing efforts.

From the point of view of technology and application, we suggest to adopt the following points: 1) Enhance the key core technology capability of cloud computing; 2) Promote the construction of cloud computing professionals; 3) Accelerate the development of industrial cloud and government cloud services.

From the perspective of industry and ecology, we suggest the following points: 1) Support the integration and transformation of traditional industries to cloud computing; 2) Overall layout of cloud computing industry ecological system construction.

6. International Exchange and Cooperation

International exchanges and cooperation can help the domestic cloud computing industry to directly introduce international leading technologies and solutions for its own use and to achieve maximum profits on the basis of minimizing costs, which is a challenge and a huge development opportunity for the domestic cloud computing industry. Combined with "the belt and road initiative", support China's cloud computing enterprises to vigorously develop the international market of cloud computing and promote trade development in the field of cloud services through overseas mergers and acquisitions, joint operations, overseas deployment of data centers and research and development institutions, etc. Using the international cooperation and exchange platform provided by the government, China's cloud computing enterprises can expand their global distribution through the establishment of research and development and sales networks, data centers and other channels, and gradually establish a professional and market-oriented overseas market service system.

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