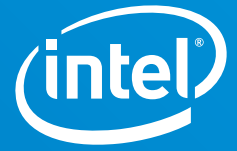


CASE STUDY



Intel® Xeon® Scalable Processor
25GbE Intel® Ethernet Network Adapter
Intel® Solid-state Drives (SSD)
Public Cloud Service
Game Cloud

Strong Computing Power, High Throughput and Stability Build Core Competitiveness of Kingsoft Game Cloud



"Kingsoft Cloud has been committed to creating efficient and stable game cloud service solutions for customers in the game industry to eliminate the customers' worries, so that their games can be uploaded to the cloud easily, run effectively and create values stably and continuously. With their excellent performance and stability, the new products and technologies of Intel, including Intel® Xeon® Scalable Processor and 25GbE Intel® Ethernet Network Adapter, help Kingsoft Cloud to win more customers, allowing us to rank top three in the competitive Chinese public cloud service market."

Tian Kaiyan
Kingsoft Cloud partner
Beijing Kingsoft Cloud Network
Technology Co., Ltd.

Mobile Internet breathes a new life into gaming. According to the data from the "2017 China's Game Industry Report (Summary Edition)", the annual sales revenue of China's game market reached RMB 203.61 billion yuan in 2017, of which revenue from mobile games accounted for the largest share, about RMB116.12 billion¹. Compared with traditional games, games based on mobile network can have a more explosive growth and focus more on timeliness in terms of product operation and market strategy. Once a game is well received by gamers, the developer needs to open hundreds of game servers within a short time, otherwise the valuable opportunity will be missed. This high elasticity is consistent with the high scalability and agility of public cloud services. Therefore, most online game vendors today prefer game cloud services from public cloud service providers instead of their own infrastructure.

The game cloud service has always been regarded as "simple" and "difficult" by industry insiders. "Simple" means that its functional logic module is not complex. "Difficult" means that the public cloud service providers must guarantee high-performance stable output for many years, which requires them to introduce advanced technology and transform the technology into service competitiveness. As a leading cloud computing service provider in China, Beijing Kingsoft Cloud Network Technology Co., Ltd. ("Kingsoft Cloud"), leveraging its rich experience in the game industry and the keen awareness of the latest industry trends and deep service requirements, is committed to taking high-performance, high-availability cloud service infrastructure as the core competitiveness to create a business system covering the whole game service process for customers.

Based on this strategy, Kingsoft Cloud, since its inception, has continued in-depth technical collaboration with Intel, a leading provider of computing, storage and network product technology in the field of cloud computing. Now, the technical base of the collaboration has been updated to Intel® Xeon® Scalable Processor, 25GbE Intel® Ethernet Network Adapter, and enterprise high performance solid-state drive (SSD). The adoption of these products and technologies significantly enhance the game cloud service capabilities of Kingsoft Cloud: its new generation Kingsoft Elastic Compute featuring optimized I/O operations can help customers obtain high performance computing and high I/O processing capabilities required for various types of games, and have high stability; Kingsoft Dedicated Cloud and Elastic Physical Cloud (EPC) can strengthen customers' manipulation and deployment of cloud resources to meet the demands for higher performance and stability. These core product service portfolios, together with Kingsoft Cloud's high quality full-process service system, can help game industry customers to speed up deployment and operation and reduce the maintenance costs. Excellent technology and service ability gains full market recognition for Kingsoft Cloud. It now has a total of more than 1,600 game industry customers, including 500 with in-depth collaboration, and operate more than 1,000 games online².

As the forerunner of China's game industry, Kingsoft Software Co., Ltd. * ("Kingsoft") introduced the first domestic game "Zhongguancun Apocalypse" in 1996*. Years later, Kingsoft Cloud, which originated from Kingsoft, chose the game cloud service as its first step into the market of public cloud services. It has successfully proved its strength in the game industry again. Kingsoft has played the role of stabilizing the market in the stage of fierce competition among numerous small providers. As the Chinese game cloud service market entered an era of highly integrated ability and influence, it became one of the giants in this field.

Such success is never accidental. Firm implementation of the differentiation strategy, active introduction of the latest technology and construction of a whole process service system for the industry ecosystem since its inception is the magic weapon for Kingsoft Cloud to secure its foothold in the public cloud, especially in the game cloud market. High performance and high stability are the core competitiveness that helps it win the favor of the market and customers. High performance can give the players smooth gaming experience and win a good reputation. Stability ensures the continuity and fairness of the game, which can not only prevent poor experience but also guarantee the continuous operating revenue of the game.

Why game cloud pursues extreme performance and stability

Some people may ask: Isn't that all game cloud services require high performance and stability? Why did the common ability become the competitive advantage of Kingsoft Cloud?

The answer is not complex, and reflects the "simple" and "difficult" characteristics of the game cloud service background architecture. The business logic of game cloud service is not complex and, although many product functions are involved, the demand is relatively "simple", and tends to be "extreme". To take the currently popular "chicken eating" game Xiaomi Gunfight* (Class I online shooting game) as an example, it runs in a series of combat nodes composed of cloud hosts and cloud databases, and Kingsoft Cloud MOBA (Multiplayer Online Battle Arena Games) composed of the surrounding load balance, data analysis and other modules. Such a framework requires high performance and stability, which means the overall computing and processing performance of the system, the network transmission performance and the stress tolerance must be as high as possible.

As you know, in intense "chicken eating" games, dozens of bullets can whistle between every two players per second. If your gun is like a shot, and the opponent is unscathed, while the opponent can shoot you dead with just a couple of bullets, this is undoubtedly devastating to the player's game experience. In-depth analysis shows that except cheating of some players, reasons may also include poor network packet transmission performance or delay, resulting in the players' slow action, thus missing the opportunity in the key process of the game. In fact, in a large online game, any short board or instability of I/O and computing performance will seriously affect the player's experience and then the revenue of the game developer.

Therefore, what the game cloud service requires is not high performance and stability, but extremely high performance and high stability, which is something that not all cloud service providers can guarantee. Industry insiders used to say that once the bank server goes down, the loss is often astronomical, while now many popular games generate even as much as one billion yuan of revenue a month. A interruption of just ten minutes in the peak period of player logins can result in an immeasurable loss in revenue and popularity. The reason why Kingsoft Cloud can make performance and stability its core competitiveness is the ultimate pursuit and practice of these two points.

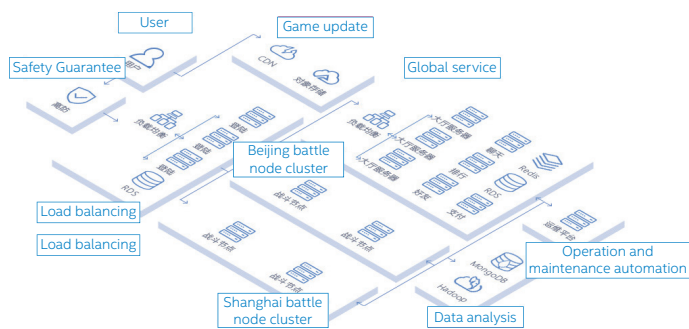


Figure 1: Kingsoft Cloud MOBA game architecture

Create high quality game cloud services with diversified products

Kingsoft Cloud's pursuit of performance and stability in game cloud services is mainly reflected in its diversified, differentiated and high-quality game cloud infrastructure services. These services are supported and realized through I/O optimized Kingsoft Elastic Compute, Kingsoft Dedicated Cloud and Elastic Physical Cloud (EPC).

I/O optimized Kingsoft Elastic Compute is the main product developed by Kingsoft Cloud for game developers. It introduces advanced products and technology of Intel from three dimensions of computing, storage and network to help customers improve the computing power of the whole system, enhance the network stability and reduce the delay. Its multi-queue concurrency processing features can effectively enhance the concurrency processing ability of the network, carry out parallel reception and processing for messages in batches, and greatly improve the packet processing capability of the virtual machine. The test data show that the new generation Kingsoft Elastic Compute can support 100,000 PPS (Packets Per Second) in normal circumstances, and automatically implement higher message rate restrictions for a part of demanding customers. Its message processing capability can be increased according to the configuration of processor and memory, with elasticity upgraded to 300,000 – 400,000 or higher. ³

Public cloud platforms usually provide services to customers by deploying virtual machines on physical hosts. Although various technologies are used to isolate virtual machines to avoid interference, resource scrambling and data security, it will eventually be limited by the resources of physical hosts.

This is obviously a disadvantage for customers who aim to provide users with better service and gaming experience. To this end, Kingsoft Cloud offers unique cloud products that allow customers to enjoy a single host exclusively, realize on-demand scheduling, independently control virtualization and avoid resource scrambling, so as to improve and optimize efficiency. This "resource plus service" model can not only avoid the problem of resource scrambling caused by the applications of different customers deployed on the same physical machine, but also allow customers to adjust the virtual machine ratio according to the business needs, so that the customers can optimize the server resources according to the changes of the game running load.

EPC, also an innovative cloud service provided by Kingsoft Cloud, is to put the physical resources and virtual machine resources in the same virtual private cloud (VPC) to provide customers with a more powerful game deployment and operation environment. Thanks to the excellent cloud network architecture of Kingsoft Cloud, the physical machine resources in the same VPC and virtual machine resources can seamlessly share various network services, including load balancing, flexible IP, and so on. This allows customers to configure and use a physical machine as easily as a virtual machine in a cloud environment, such as using a console switchboard, performing a backup, snapshot, and other functions. When the game has a specific requirement for a performance indicator, such as the 20Gbps network bandwidth, or a million PPS packet forwarding capability, the customer does not have to spend a lot of money to purchase high-end virtual machine resources, but just have to deploy the corresponding physical machine resources, such as the new Intel® Xeon® Scalable Processor based high-performance server physical machine in the corresponding VPC.

The combination of these three products not only allows customers to flexibly collocate in accordance with actual needs to meet the I/O performance and stability needed for the game operation, but also makes maintenance easy. For example, every scene in Xiaomi Gunfight involves hundreds of players in the real time gun battle, so it has very high requirements for the system's computing performance, storage performance and network throughput. In addition to Kingsoft Elastic Compute, Kingsoft Cloud provides a physical server based on a high-performance Intel processor for each scene to ensure its high performance and stability.

Introduce a number of Intel's leading technologies: A strong core ensures a high performance

These three heavyweight products for the Kingsoft game cloud service have a common feature. In addition to the flexible, efficient and easy to use cloud platform resource management and deployment technology, they are equipped with high performance, high reliability and high availability hardware products and techniques, and most core components are from Intel, a long-term partner of Kingsoft Cloud and leader in the field of cloud computing.

First, in terms of computing performance, both the previous Intel® Xeon® E5 product family and the new Intel® Xeon® Scalable Processor continuously provide strong computing power for Kingsoft Cloud's game cloud products. In particular, the new-generation Intel® Xeon® Scalable Processor not only performs well in the core metrics of microarchitecture, such as kernel number and cache, but also integrates a large number of hardware enhancements to respond to the customer's requirements on fine management of resources in the cloud environment and the acceleration of specific workloads. For example, Intel® AVX 512 technology can significantly enhance the processing efficiency of parallel computing. Tests based on the cloud service environment of the Kingsoft Cloud game show that, after upgrading to the Xeon® Platinum p8168 processor in the new generation Intel® Xeon® Scalable Processor family, the comprehensive performance of the virtual cloud host cases using the same 8-core vCPU in the same game scenario improves by 10%-15% as a whole compared to cases based on the previous generation Xeon® E5-2690 V4, while the density of high-performance virtual cloud hosts that can be carried by a single physical machine can be increased by more than 60%⁴.

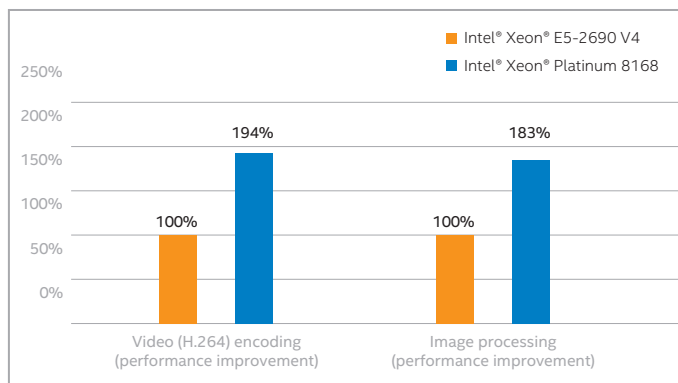


Figure 2: Other performance test scores of Kingsoft Cloud after upgrading to Xeon® Scalable Processor⁵

Improving network adapter performance is also an important means to optimize I/O performance, improve stability and reduce delay in Kingsoft Cloud network. With the introduction of products and technologies such as 25GbE Intel® Ethernet Network Adapter, Kingsoft Cloud provides a good upgrade and migration path for customers requiring high bandwidth: it can meet host traffic and block traffic at the same time with a new network adapter, not only to meet customers' needs for high bandwidth, but also to achieve high data throughput and low latency workload, thereby reducing network latency, power consumption and TCO. For network performance tuning, technicians of Kingsoft Cloud are very familiar with Intel's open source DPDK* technology. They know well how to use this technology to speed up the network performance in the multi core environment, and apply it on the new generation I/O optimized cloud hosts based on Intel® Xeon® Platinum 8168 Processor and 25GbE Intel® Ethernet Network Adapter, increasing the message handling capacity by 3 times and the network throughput of the whole machine to 40Gbps⁶.

In addition to computing and network, many games also require frequent data read/write operations, so customers have high requirements for the storage module's IOPS (Input/Output Operations Per Second) performance. Many new products of Kingsoft Cloud adopt Intel® 3D NAND TLC technology based Intel® SSD DC S4500 series, which have the industry-leading storage density, and thus can effectively help Kingsoft Cloud products improve storage performance. In the future, Kingsoft Cloud will also use Intel® SSD DC P4500 series supporting NVMe to further improve the storage performance, so that Kingsoft Cloud products will have more satisfactory performance in improving IOPS and reducing delay.

Conclusion

While building and optimizing its core competitiveness - the performance and stability of the game cloud service, Kingsoft Cloud also esteems innovation in service concept and process, which is also important for winning customers. In the eyes of Kingsoft Cloud, the game cloud service is not simply about selling cloud products or services to customers, but more importantly, building a complete set of appropriate and reasonable solutions for customers based on the cloud service capability of Kingsoft Cloud. Therefore, the service process of Kingsoft Cloud often starts at the beginning of the game development. It can focus on the problems encountered by the customers at every stage of product development, operation and maintenance, and put forward effective solutions. For example, in the operation and maintenance stage of a game, Kingsoft Cloud integrated resources in order to solve the problems of short project period and complex configuration management. Leveraging its own and its partners' efforts, Kingsoft Cloud provided the voice chat, payment function and other public abilities or game components to the customers to speed up the deployment of the game, reduce the risk of operation and maintenance, and win more time and space for its market development.

With the versatile and excellent product capability, and the full range of services, Kingsoft Cloud has been a leading game cloud service provider in China. Now, Kingsoft Game Cloud has 30 large data centers worldwide, a total of 80,000 servers, more than 600 global CDN nodes and over 20T CDN bandwidth over the whole network. Of the top 1000 game developers in China, 90% have cooperated with

Kingsoft Cloud⁷. At the same time, Kingsoft Cloud is also promoting its experience in game cloud services to other industries such as video, financial and healthcare. By working on the latest technologies such as block chain, and analyzing the possibility of combining them with the existing cloud services, it aims to create new business growth points through investment, cooperation or independent R&D.

With a view to the future, Kingsoft Cloud will continue to invest in its core competitiveness. Therefore, it will deepen the collaboration with Intel to further promote the innovation of cloud service products and solutions with advanced computing, network and storage capabilities, and to build a more perfect game cloud ecological service system. This collaboration will not only be limited to game cloud, video cloud service and other areas in which Kingsoft Cloud has competitive advantages. Kingsoft Cloud also hopes to jointly explore new technologies such as the Internet of Things and artificial intelligence with Intel, to jointly lead the future of the intelligent Internet and cloud services.

Experience:

The features of online games pose a serious challenge to the performance of the cloud platform. Any hardware short board or shortage may cause delay, downtime and other accidents, compromising the gaming experience and causing the loss of players. Intel® Xeon® Scalable Processor, Intel® SSD, and 25GbE Intel® Ethernet Network Adapter help Kingsoft Cloud to build cloud services featuring outstanding performance and stability from three dimensions of computing, storage and network, so that it can effectively cope with the challenge of huge user traffic.

The diversified customer demands in the game industry has driven Kingsoft Cloud to innovate constantly and develop a variety of products and a full service ecosystem to help customers cope with the challenge of different needs. Combining with Intel's high performance products and technology, Kingsoft Cloud's dedicated cloud and EPC products have been proven to be able to effectively help customers improve their game experience in a series of deployment practices, and have won market recognition.



¹ The "2017 China's Game Industry Report (summary version)" was released by the Game Committee of China Audio-Video and Digital Publishing Association

^{2,7} Related data are provided by Kingsoft Cloud

^{3,4,5,6} Related data are from Kingsoft Cloud's game cloud service environment test

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