2022 China Gaming Cloud Service Market Research

2022年中国游戏云市场报告

2022年中国ゲームクラウド市場報告

Key Points:
cloud-side collaboration;
development via cloud;
operation and maintenance via cloud

2022.12

Instruction

Frost & Sullivan and Leadleo Research Institute hereby release the annual report "2022 China Gaming Cloud Service Market Report" as one of the China cloud computing series reports. This report aims to analyze current situation, application prospects, technical trends and development trends of China Gaming Cloud service market, and to identify the competitive landscape in the Gaming Cloud service market, while reflecting respective competitive advantages of leading vendors in this market segment.

Frost & Sullivan and LeadLeo Research Institute conducted downstream user experience surveys on Gaming Cloud Service market. Respondents are of different sizes and in different segments in each of its industry that includes consumption, media, operators.

Trends in Gaming Cloud Service market presented in this report also reflect trends in the Cloud Service industry as a whole. The report's final judgment on market ranking and leadership echelon are only applicable to the industry development cycle of this year.

All figures, tables and text in this report are based on the surveys from Frost & Sullivan China and LeadLeo Research Institute. All data are rounded to one decimal place.

Contents

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Chapter 1 Overview of Gaming Cloud Service Market of China

1.1 What is the basic architecture of the Gaming Cloud service and how do vendors efficiently implement information flow transmission?

1.2 What is the application status and user demand of different segments of Gaming Cloud service?

➢ The multi-level cloud architecture can be divided into Gaming Cloud service content layer, Gaming Cloud PaaS layer, and Gaming Cloud IaaS layer. This multi-level architecture help achieve efficient information flow transmission for game developers and operator.

➢ The multi-scenario practice of Gaming Cloud service broadened concerning user coverage, enriched application scenarios, and attracted loyal paying users while strengthening deep-binding user relationship. Along with hardware upgrading progress, Gaming Cloud service vendors fully considered the existing demands of game developers and gamers. Further technical methods such as edge computing and GPU multi-channel rendering also promoted Gaming Cloud service to grow with a faster pace.

1.1

Gaming Cloud Service Infrastructure

❑ **Gaming Cloud service utilizes multi-layered architecture to achieve efficient information flow transmission**

To achieve more efficiency in game development, game operation, game dissemination and game distribution, Gaming Cloud service began to be widely used by game developing companies. The architecture of gaming cloud service mainly includes gaming cloud content layer, gaming cloud PaaS layer and gaming cloud IaaS layer. While the computing power of game operation evolves, end-devices for players to reach gaming content also gradually expanded, including cell phones, tablets, PCs, large-screen entertainment systems, VR all-in-one machines, etc.

Gaming Cloud service enjoy features such as long-term connection retention session, long-term state maintenance, low-latency network, high IO throughput, and high computing performance. The gaming scenario enquires fluent interaction among gamers. While cloud service structure is progressively layered and decoupled, users still require high computing power from the underlying server. Hence, It is necessary to solve issues concerning cloud rendering, streaming, encoding and decoding, and meet up with requirement from cloud mobile games, mobile games, VR and even enterprise-level visual rendering scenarios.

Figure 1: Schematic diagram of the Gaming Cloud service infrastructure
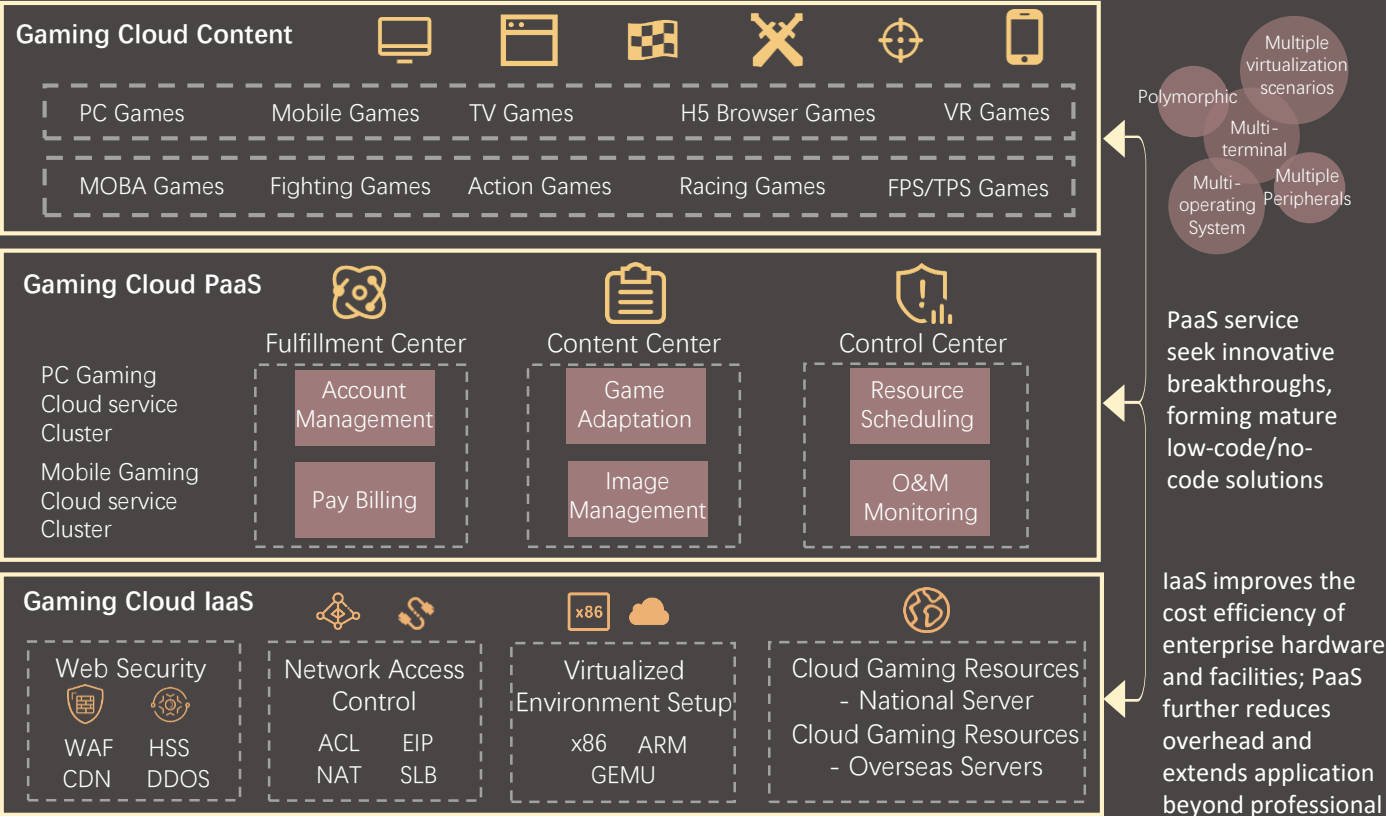
1.2
Core Demaning Points of Gaming Cloud Services

❑ **Emerging integration between gaming cloud service and game multi-consumption scenes; paying willingness of C-end users increased**

The integration of gaming cloud services with VR, live streaming, advertising, shopping and other emerging scenarios further expands the range of users reached and covered by various game workshops and enhances the richness of game payment scenarios. Based on solid industry chain resources on cloud computing, gaming cloud service providers gradually strengthen gaming cloud products and function matrix, and help game enterprises with rich development tools, promotion and distribution channels to attract more C-end consumers to participate and make payment. This deepens the binding effect between and application depth of gaming cloud services and game industry while expanding the revenue scale of the whole game industry.

Figure 2: Gaming Cloud service function application and key points of user demand

- Multi-way parallel rendering and isolation;
- High-performance transfer/memory interface;
- Multi-chip cascade, improved display rendering and codec performance; larger amounts of memory

- Ensure stable bandwidth and network bandwidth requirements;
- Compute nodes deployed in edge data centers; improve transmission efficiency and reduce end-to-end latency

- Maximize server-side hardware performance
- Manage massive applications and reduce cost of cloud gaming operation

- The encoding pushing flow supports dynamic bitrate to ensure low packet loss
- Support anti-shake image and enhance experience
- Detect network bandwidth accurately and timely; adjust dynamic code streams dynamically

- 5G provides ample bandwidth space to meet high bandwidth demands
- Physical implementation, network upgrades, and other technologies to meet low-latency requirements
- Enhance end-to-end netwrok slicing technology to meet network stability requirements

GPU Multi-interface cascade

Streaming technology

Edge computing

5G communication

Virtualization and container capability

❑ **Clear pursuit of integration between Gaming Cloud service and big data, AI, 5G and other emerging technology**

From the perspective of game developers and other entities served by Gaming Cloud service vendors, hardware upgrading and innovation is only part of their main focus. These entities also put more efforts in pursuing cheaper and high-quality cloud services. Gaming Cloud service providers need to continuously expand their service scale and improve could computing quality to meet up with customer needs.

Edge computing technology enables computing resource from service platforms to sink closer to the user side, shortening latency and improving user experience. Also, Increasing user demand on GPU related functions has spawned multi-form of cloud computing service and differentiated method on configuration. The implementation of Gaming Cloud services structure is also accelerated by multiple 5G application scenarios, such as mobile broadband (eMBB), ultra-reliable and low-latency communication (uRLLC), and massive machine-based communication (mMTC).

Chapter 2 Gaming Cloud Service - Convergence of Emerging Technologies

2.1 How does 5G technology converge with Gaming Cloud service? And how does the process go?

2.2 Under what kind of scenarios is intelligent technology applied to and integrated with the Gaming Cloud service?

➢ Favorable factors from both the market environment and industry chain ecology promoted the development of 5G technology. The convergence between 5G technology and Gaming Cloud service took a big leap from theoretically feasible to commercial take-off during the past two decades.

➢ Intelligent technology is also widely applied to the Gaming Cloud service industry, help forming an intertwining technical system, and promotes the construction of AL/ML cloud service ecology to become the underlying foundation of Internet service of the next-generation.

2.1
5G Technology Integration & Application

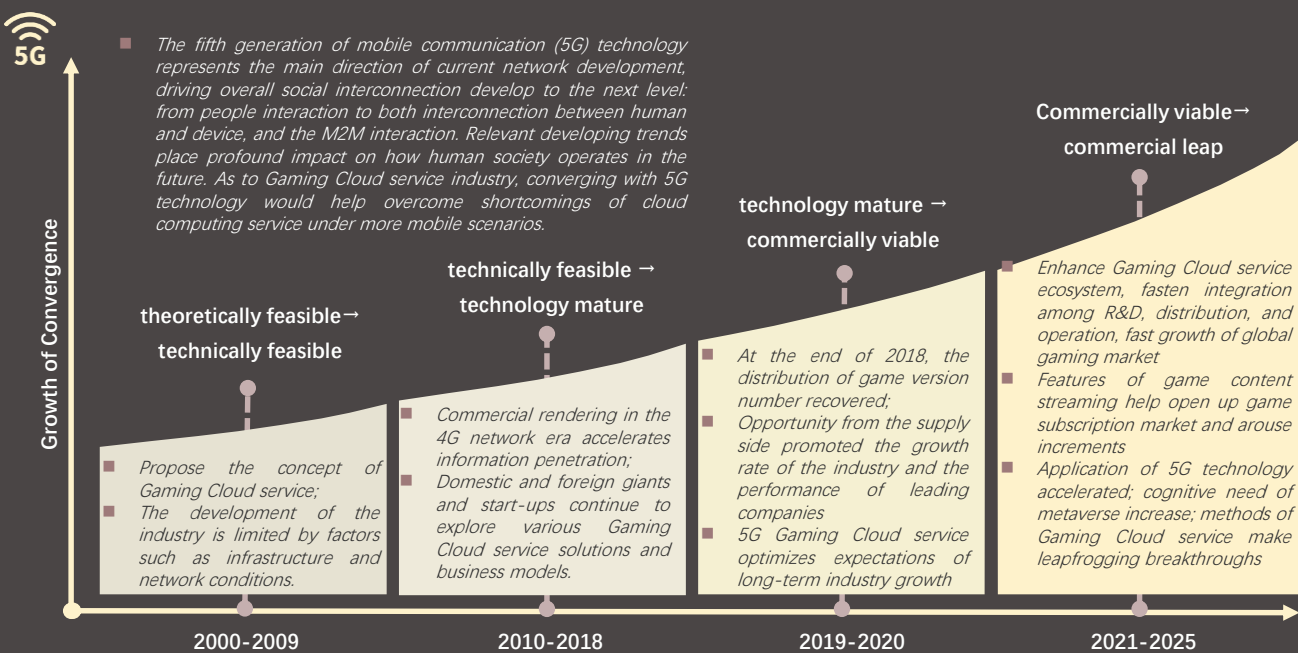❏ **Favorable market factors: positive signals from consuming side**

We have witnessed harsh challenges from the COVID pandemic within the past three years. And at current stage, we face urgent need from market to seek quick rebounce in economic development. Potential consumption in the global market is further released by actively enriching the application scenarios of 5G technology, driving the consumption of 5G cell phones and other terminals, promoting other consumption in e-commerce, and encouraging online education and online entertainment, etc. Up to now, China Mobile has built about 300,000 5G base stations, aiming to cover all nationwide cities above the prefecture level with 5G networks. As 5G networks and terminals gradually gain acceleration in popularity and application, the obvious advantages of high speed, low latency and wide connectivity were given full play and greatly enhanced experience for gamers.

❏ **Favorable ecology factors: extension and reinforcement of industry chain**

Along with changes in consumers' perception of payment scenarios, as an emerging part of the cloud computing economy, the Gaming Cloud service is now leading the cloud industry to become one of the most significant influencer and market booster under the pandemic. The effect of "stay-at-home economy" accelerates the penetration of games among potential users, driving more potential end point users to notice and enjoy cloud gaming, hence nurturing user habits to purchase different form of cloud platform related service. Leading enterprises within cloud service industry use their own advantages to drive continuous growth of the Gaming Cloud service market.

Game content developers such as Tencent and NetEase also play a vital role in the Gaming Cloud service industry chain. By gradually migrating from traditional developing platform to cloud developing platform, while paying more attention to game content and increasing investment in production and research of high-quality games and large-scale games.

Figure 3: Convergence of Gaming Cloud service with 5G

5G

The fifth generation of mobile communication (5G) technology represents the main direction of current network development, driving overall social interconnection develop to the next level: from people interaction to both interconnection between human and device, and the M2M interaction. Relevant developing trends place profound impact on how human society operates in the future. As to Gaming Cloud service industry, converging with 5G technology would help overcome shortcomings of cloud computing service under more mobile scenarios.

Growth of Convergence

Commercially viable→
commercial leap

technology mature →
commercially viable

technically feasible →
technology mature

theoretically feasible→
technically feasible

- *Propose the concept of Gaming Cloud service;*
- *The development of the industry is limited by factors such as infrastructure and network conditions.*

- *Commercial rendering in the 4G network era accelerates information penetration;*
- *Domestic and foreign giants and start-ups continue to explore various Gaming Cloud service solutions and business models.*

- *At the end of 2018, the distribution of game version number recovered;*
- *Opportunity from the supply side promoted the growth rate of the industry and the performance of leading companies*
- *5G Gaming Cloud service optimizes expectations of long-term industry growth*

- *Enhance Gaming Cloud service ecosystem, fasten integration among R&D, distribution, and operation, fast growth of global gaming market*
- *Features of game content streaming help open up game subscription market and arouse increments*
- *Application of 5G technology accelerated; cognitive need of metaverse increase; methods of Gaming Cloud service make leapfrogging breakthroughs*

2000-2009   **2010-2018**   **2019-2020**   **2021-2025**

2.2

Intelligent Technology Integration & Application

Electronic devices such as game consoles, mobile phones, AR/VR devices are systems derived from traditional computing systems for specific purposes. Based on different forms of devices, Intelligent technology such as computer language design, computer algorithm design, computer graphics, software and hardware architecture, network debugging and adaptation, interactive devices and many others are broadly applied and upgraded with a fast pace, while promoting the development, operation and maintenance efficiency of Gaming Cloud service. The way that intelligent technology integrate with Gaming Cloud service can be divided into three periods.

❑   Basic Convergence

At this point, service related to game development and operation begin to merge with intelligent technology on a basic level. Intelligent technology help assist rule design of the architecture of Gaming Cloud service and help form automatic functions for game development.
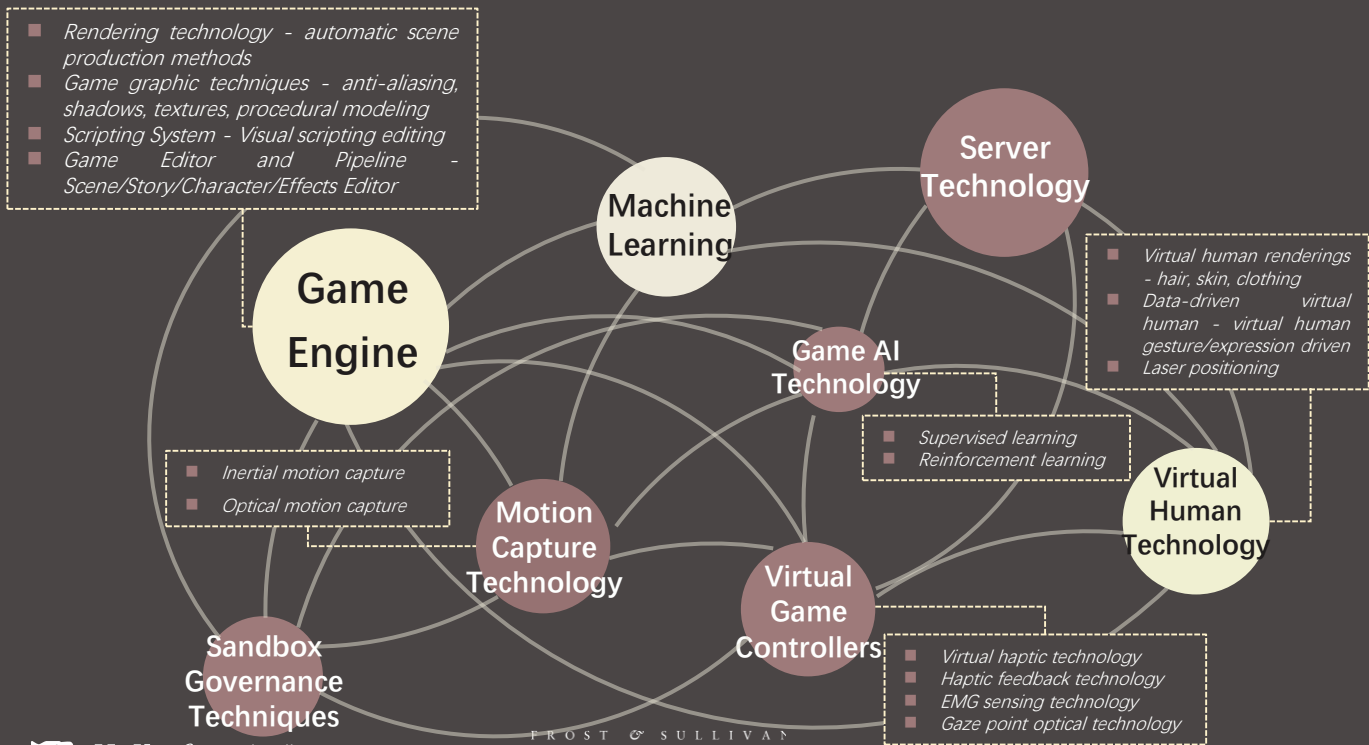
❑   Convergence and technology iteration

Cloud service vendors have preliminary experience in the application of intelligent technology in game business and begin to try to accelerate the development and adaptation of intelligent tools in user interaction experience upgrading, massive data correlation analysis, automated operation and distribution, etc.

❑   Convergence and function spillover

The application of intelligent technology in the game field comes to mature, and the application of intelligent technology in the front-end expanded to fields like personalized content creation, numerical value tuning, game logic design, AI competitive robot, private domain socialization, etc. In the back-end, it provides more mature solutions for game enterprises in public opinion analysis, advertising and precise promotion.

Figure 4: Intelligent technology and Gaming Cloud service integration mapping

- Rendering technology - automatic scene production methods
- Game graphic techniques - anti-aliasing, shadows, textures, procedural modeling
- Scripting System - Visual scripting editing
- Game Editor and Pipeline - Scene/Story/Character/Effects Editor

Machine Learning

Server Technology

Game Engine

Game AI Technology

- Virtual human renderings - hair, skin, clothing
- Data-driven virtual human - virtual human gesture/expression driven
- Laser positioning

- Supervised learning
- Reinforcement learning

- Inertial motion capture
- Optical motion capture

Motion Capture Technology

Virtual Human Technology

Virtual Game Controllers

Sandbox Governance Techniques

- Virtual haptic technology
- Haptic feedback technology
- EMG sensing technology
- Gaze point optical technology

Chapter 3: Opportunities in and Challenges to Gaming Cloud Service Market of China

3.1 What knid of application scenarios are involved in the gaming cloud service and what knid of opportunities exist?

3.2 What are bottlenecks and challenges to technology upgrade and iteration within gaming cloud service?

➢ The Gaming Cloud vendors face many customer groups, including game developers, game publishers, game operation platforms, game media platforms and the gamers group, and the personalized demands of different customer groups bring opportunities for gaming cloud service market to expand.

➢ The Gaming Cloud service industry in China faces opportunities and challenges at the same time. Concerning requirement of network security protection, complex dynamic database construction, and rich global backbone network construction, cloud service providers need to combine their own advantages and grow from single-point technology breakthrough to comprehensive technology stack construction.

3.1
Opportunities in Scenario Expansion

Gaming Cloud service face multiple user groups, including game developers, game operators, communication operators, etc. Vendors provide customized services to stimulate potential consumption and help customers to upgrade their capacity.

Low Configuration Multi-Terminal

Game Masterpieces Experience

Vendors support users to run games across multiple terminals (PC terminal, mobile terminal, web page, workload, etc.) simultaneously by adapting to gaming cloud platforms. Owe to upgraded functions concerning GPU virtualization, edge computing, container technology, audio and video codec technology, cloud service help gamers who can only get access to low-end equipment find suitable ways to reach heavy load games, hence reduce threshold and help developers to improve user accumulation and retention rate.

Download-Free, Installation-Free,

Cloud Trial

Gaming Cloud supports multiple traffic entrances, including advertising slots, information streams, application market, etc. Through lightweighted entry, users can access games without downloading, hence increase game conversion rate. Through cloud service functions, video website operator could greatly improve efficiency in video traffic conversion. For example, game hosts can transfer gaming control to fans in video stream or let viewers to enter game scene directly through video stream.

Large Screen High Image Quality

Smooth Interactive Experience

Game developers cooperate with smart TV manufacturers by rendering technical system through cloud platforms and provide high-quality game experience for large-screen TV users, almost as well performed as professional gaming devices in terms of image quality and latency standards. By connecting gamepad or cell phone virtual handler with large-screen TV system, more players would be attracted to large-screen scenario and hence release potential demand for big screen game experience.

Simple Installation Preloading

Game Instant Launching

Gaming cloud service vendors support real-time cloud rendering to help game developers efficiently build one-stop "game micro-end", providing gamers with additional functions such as cloud trial, silent download, login/payment penetration and update package free installation. Players with low-end cell phone configuration can get game experience almost the same as original gaming terminals through micro end package. Reduced package size can effectively lower cost of customer acquisition and improve launch effect.

3.3
Technology upgrade challenges

The Gaming Cloud service industry in China faces opportunities and challenges at the same time. Concerning requirement of network security protection, complex dynamic database construction, and rich global backbone network construction, cloud service providers need to combine their own advantages and grow from single-point technology breakthrough to comprehensive technology stack construction.

❑ **Gaming cloud service faces multi-faceted security threats**

With the expansion of the deployment scale and the scope of global network collaboration, coupled with the edge computing architecture collaboration, GPU virtualization and the complex information flow (audio and video streams), the exposure of the gaming cloud assets has increased, and the global attackers carried out more frequent and decentralized attacks on the gaming cloud-related network facilities, aiming at paralyzing the facilities and extorting high ransoms, and implement DDoS attacks on networks and applications, and this would pose challenges to the stability of the gaming cloud.

In addition, there are security loopholes in different parts of the game production chain, such as design, implementation and testing. This requires cloud service providers to take comprehensive measures such as threat modeling, security code review, fuzzy testing and security testing to take control in front and minimize risks caused by security events.

❑ **Cross-services and cross-regional data synchronization**

In order to help gamers meet less restriction from region while experiencing high-quality games from Chinese game developers and share game strategies, game experiences and form battle teams through multiple social channels, gaming cloud service providers need to ensure that user-device interaction data and device-device interaction data (M2M) can be efficiently and smoothly synchronized globally. Gaming cloud service providers need to build globally unified account system by constructing global synchronized multi-writing database and by using cross-regional data replication architecture to create stable and safe account synchronization experience for gamers.

❑ **Global-level matchmaking gamers seek ultra-low latency**

Cross-border matchmaking and global gaming scenarios break national boundaries, and the gaming cloud architecture help gamers in different regions and language systems achieve smooth interaction in various cooperative scenarios and competitive matchmaking scenarios.

Under the demand-oriented influence from "microservice + automation", cloud service providers face multiple challenges: to further control bandwidth costs while promoting architecture automation and high-performance transmission efficiency.

Figure 6: Global Service implements multi-write synchronous relational/non-relational database
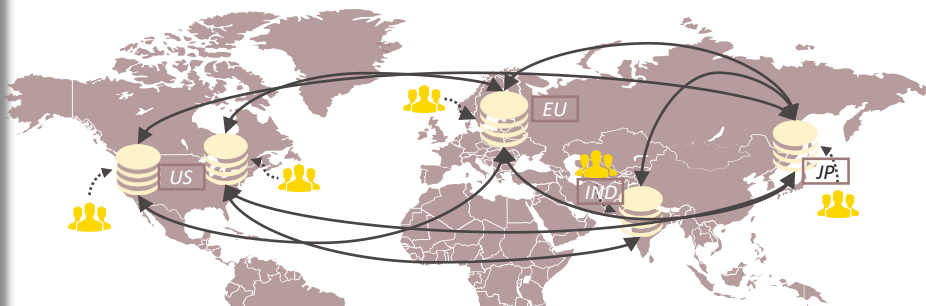
Pain points of the global server game:
- Architecture design: different types of games design and how to deploy game access layer, logic layer and data layer
- Network delay: Players in different regions can access the game smoothly
- Data R/W: Reading and writing data efficiently and maintain data consistency
- Resource management: Unified and efficient game operation and maintenance and resource management

Chapter 4 Trends in application of Gaming Cloud Computing Resource

4.1 Customized Cloud Computing Power applied to gaming cloud service

4.2 Reusing computing resource within gaming cloud service

4.3 Trends of traffic entrance and terminal devices

➢ The growing trend of customized cloud computing service is mainly manifested by three points, namely the optimization from product side, the improvement from technical side and the improvement from service side.

➢ The development of computing power includes the improvement of infrastructure capabilities and the increase in computing efficiency. The multiplexing of computing power is conducive to the efficient use of computing power and the realization of global optimization.

➢ The mainstream entrance to game content is more diversified and large screen gaming experience is under pursuit; the continuous expansion of cloud intelligent terminal market creates momentum for continuous growth in game and gaming cloud business.

4.1

Customized Cloud Computing Services Applied to Gaming Cloud Scenario

> *"Cloud computing power services are becoming a new delivery form, enabling the high-quality development of the computing economy."*
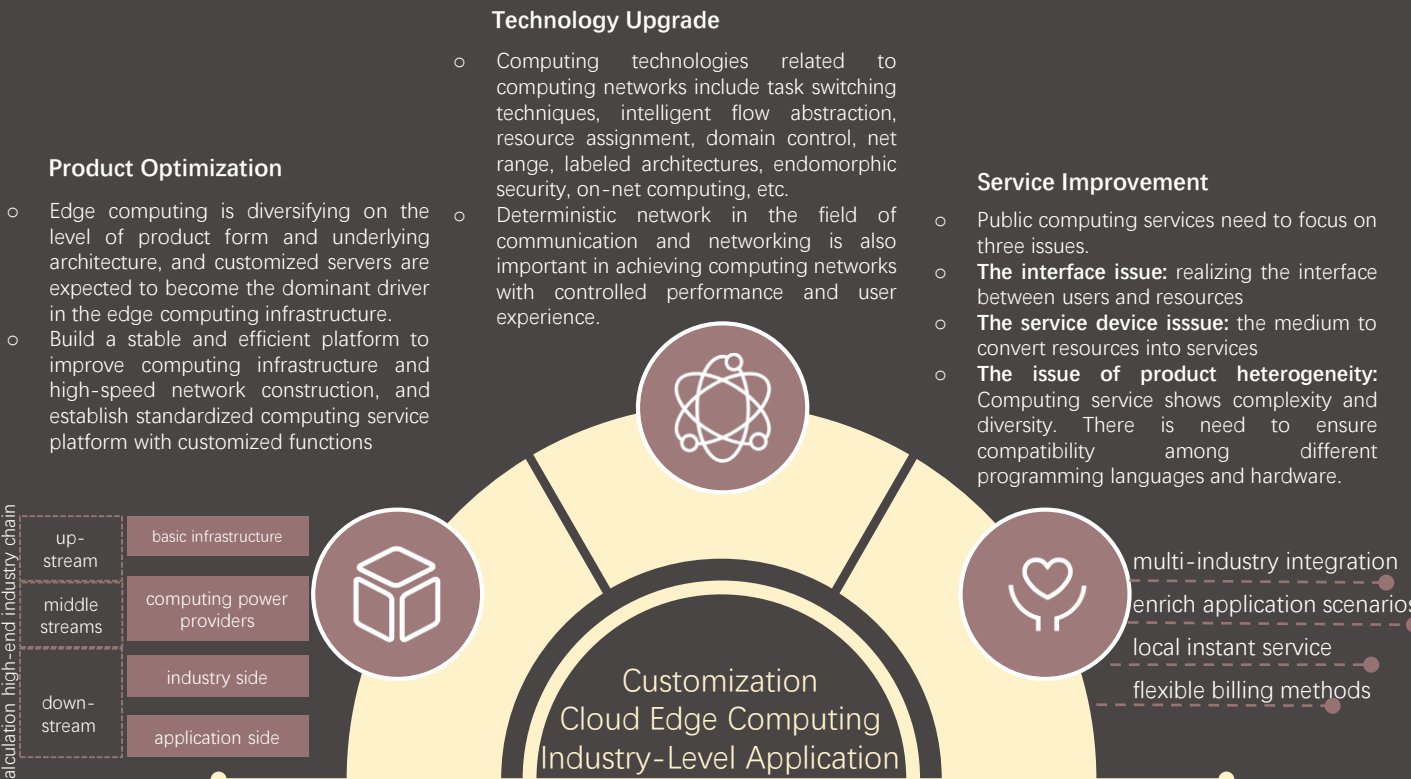>
> ——Baohong, He， Director of the Institute of Cloud Computing and Big Data, CAICT

As a new type of resource delivery method, computing service has gradually derived from basic cloud computing to AI computing, supercomputing and other modes, and the computing efficiency can be measured and optimized through the dimensions of connection, volume, elasticity and capacity of computing. The application of customized computing service to gaming business mainly shows following characteristics.

(1) Gaming cloud resources integrate heterogeneous computing power to promote the universality of computing service to game enterprises of different scales;

(2) Multi-layer hierarchical computing resources promote the ubiquity of gaming cloud services in different aspects of the gaming business;

(3) The gaming cloud resources unify the computing output standard and promote the standardization of computing service in the gaming industry.

Compared with the initial centralized cloud service model, the cloud-edge collaborative computing service model has richer connotation, including the computing resource from the whole chain of cloud, edge and end; intelligent computing power is more user-centered, providing customized services, helping the traditional industry transform and upgrade, and constructing more effective R&D, operation and promotion workflow for gaming industry.

## Figure 7: Customized Cloud Computing Application Points

Technology Upgrade

o Computing technologies related to computing networks include task switching techniques, intelligent flow abstraction, resource assignment, domain control, net range, labeled architectures, endomorphic security, on-net computing, etc.
o Deterministic network in the field of communication and networking is also important in achieving computing networks with controlled performance and user experience.

Product Optimization

o Edge computing is diversifying on the level of product form and underlying architecture, and customized servers are expected to become the dominant driver in the edge computing infrastructure.
o Build a stable and efficient platform to improve computing infrastructure and high-speed network construction, and establish standardized computing service platform with customized functions

Service Improvement

o Public computing services need to focus on three issues.
o **The interface issue:** realizing the interface between users and resources
o **The service device isssue:** the medium to convert resources into services
o **The issue of product heterogeneity:** Computing service shows complexity and diversity. There is need to ensure compatibility among different programming languages and hardware.

Smart calculation high-end industry chain

up-stream	basic infrastructure
middle streams	computing power providers
down-stream	industry side
	application side

Customization
Cloud Edge Computing
Industry-Level Application

multi-industry integration
enrich application scenarios
local instant service
flexible billing methods

4.2

Reusing Computing Power within Gaming Cloud Scenario

❑ **Efficient utilization of computing system to achieve global optimization of computing power**

Based on the complex network demand and requirement to optimize computing resource, cloud service providers gradually master the computing network linkage control solution. Through the integrated management and collaborative scheduling of multiple resources such as network, storage and others, vendors achieve the global optimization of connectivity and computing. The linkage control solution includes centralized solution, distributed solution, hybrid solution and other routes in technical implementation, and would help realize the route reachability of computing nodes and fully mobilize the control ability of IP router nodes.

Service providers can reuse the resources under the existing IP network, and improve the computing information distribution efficiency while fully considering real-time network status and computing resource invocation status, hence support high-speed scheduling of different applications, and ensure that massive applications can reach the appropriate computing nodes.

Figure 8: Computing power development and typical application bearing requirements
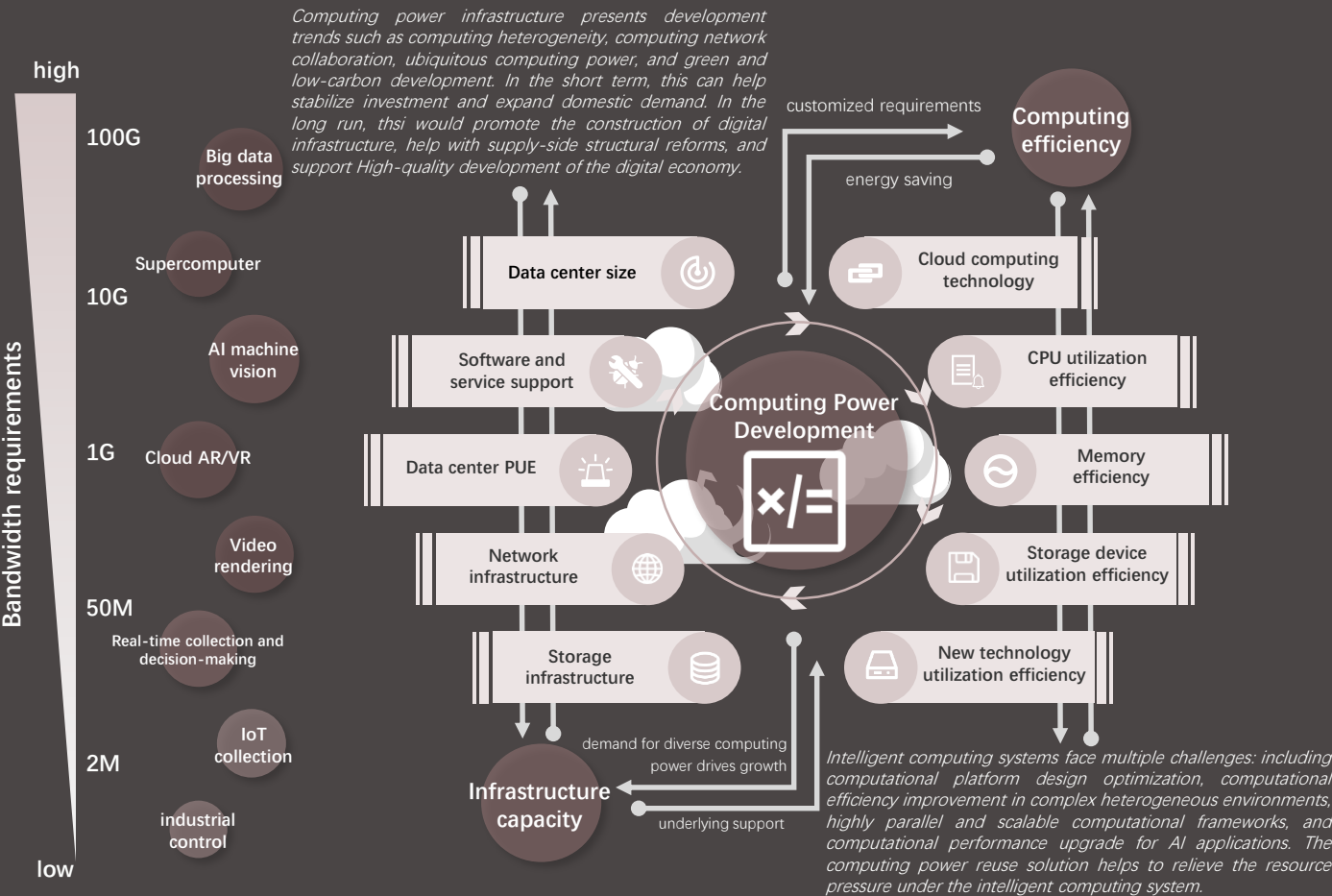
4.3
Trend in Network Traffic and Terminal Development

❑ **Diversified development of traffic entrances and rapid popularization of cross-system workflow**

Currently, the mainstream traffic entrances of cloud gaming include cell phones, tablets, PCs, etc. Terminals like smart TVs, VR/AR devices, smart cars and other end point devices also gradually become potential gaming traffic entrances. The existing market bonus in smart terminal market also bring strong increasing potential for the development of gaming cloud. With the combination of "Large screen + ultra-high definition + game handle", more and more host-like gaming system can create ultimate user experience for players. In this case, large-screen gaming scenario also become one of the key targets of gaming cloud services vendors. The growing application of game content platforms help game developers to switch flexibly and optimize workflow collaboration among Windows, OS, Android, IOS, Linux, TV, browser and other heterogeneous systems.

❑ **Requirement for fast upgrade and iteration of system and hardware also drive creation of game and deployment of gaming cloud service**

Factors such as rapid iteration of screen technology, upgraded mobile side network connection, various entertaining scenario from TV side, improved content experience through game consoles, and steady raise of PC ownership all contribute to the expanded gamer groups. During the period of the COVID pandemic, we have noticed proliferation of remote interactive scenes. This help promote end-device consuming market enter into a new incremental cycle. Living room TV come to play more of a vital role in remote education, meeting, entertainment and other social conditions. Hence, living room interactive entertainment begin to provide new opportunities towards gaming cloud service.

Figure 9: Growth of Cloud Gaming Smart Terminals

The continuous demand in many emerging markets such as Central and Eastern Europe, Asia Pacific, Middle East and Africa promotes the steady growth of the smartphone market and expands the potential scale of mobile cloud game users

Smartphone manufacturers and Internet content developers enter the large-screen entertainment system market, promoting games and gaming cloud vendors to penetrate the "living room scene", forming a multi-system interaction among mobile, host and large-screen

High-quality exclusive content is expected to further attract and stimulate willingness of potential gamer to pay, and promote gaming cloud service providers to help increase value for high-quality game content with high-quality computing resources.

Chapter 5: Competitive Landscape of Gaming Cloud Service Market of China

3.1 Assessment Criteria

3.2 Comprehensive Vendor Assessment

- Leading Competitor: Amazon Web Services (AWS)

- Leading Competitor: Tencent Cloud

- Leading Competitor: Huawei Cloud

Assessment Criteria

- Frost&Sullivan assess the competitive landscape of Gaming Cloud service vendors with the criteria of growth index and innovation index

	Tier 1 Indicators	Tier 2 Indicators	Key Points
Growth Index	Infrastructure Performance	Computing power and Resources	Computing power stability, instantaneous computing power, elastic resource allocation, etc.
		Computing and Storage	Cloud datalink quality, elastic storage, and agile deployment, etc.
	Service Effectiveness	Inntranet bandwidth incl.	Bandwidth expansion, resource loss reduction, etc.
	Cloud-Edge Communication	Edge Node Performance	Stability, rate, delay, etc. of CDN node
		Cloud-Edge Scheduling	Advantages in resource scheduling of cloud-edge communication
	Trusted Cloud for Gaming	Data Security	Effectiveness of storage security and data security
		Authentication & Incident Response	Effectiveness of login authentication and response to security events

	Tier 1 Indicator	Tier 2 Indicator	Key Points
Innovation Index	Technology Integration	5G & Automation	Integration effectiveness of 5G and automated analytics
		Data mangement & Cloud native	Integration effectiveness of cloud-native capabilities and data management
	Industrial Empowerment	Tech-up & Cost-down for R&D	Product-efficiency improvements in R&D and operational management
		Business mode Innovation	Innovative strengths in terms of partnership models and pricing schemes
	Continuous Deployment	DevOps application	User experience facilitation with continuous development and deployment
	Market Influence	Industry Contribution	Contribution to the industry growth and guidance to the cross-border market

Comprehensive Vendor Assessment
Frost Radar (弗若斯特雷达)^{TM}

❑ **Comprehensive Assessment of Gaming Cloud Service market in China——Frost Radar^{TM}**
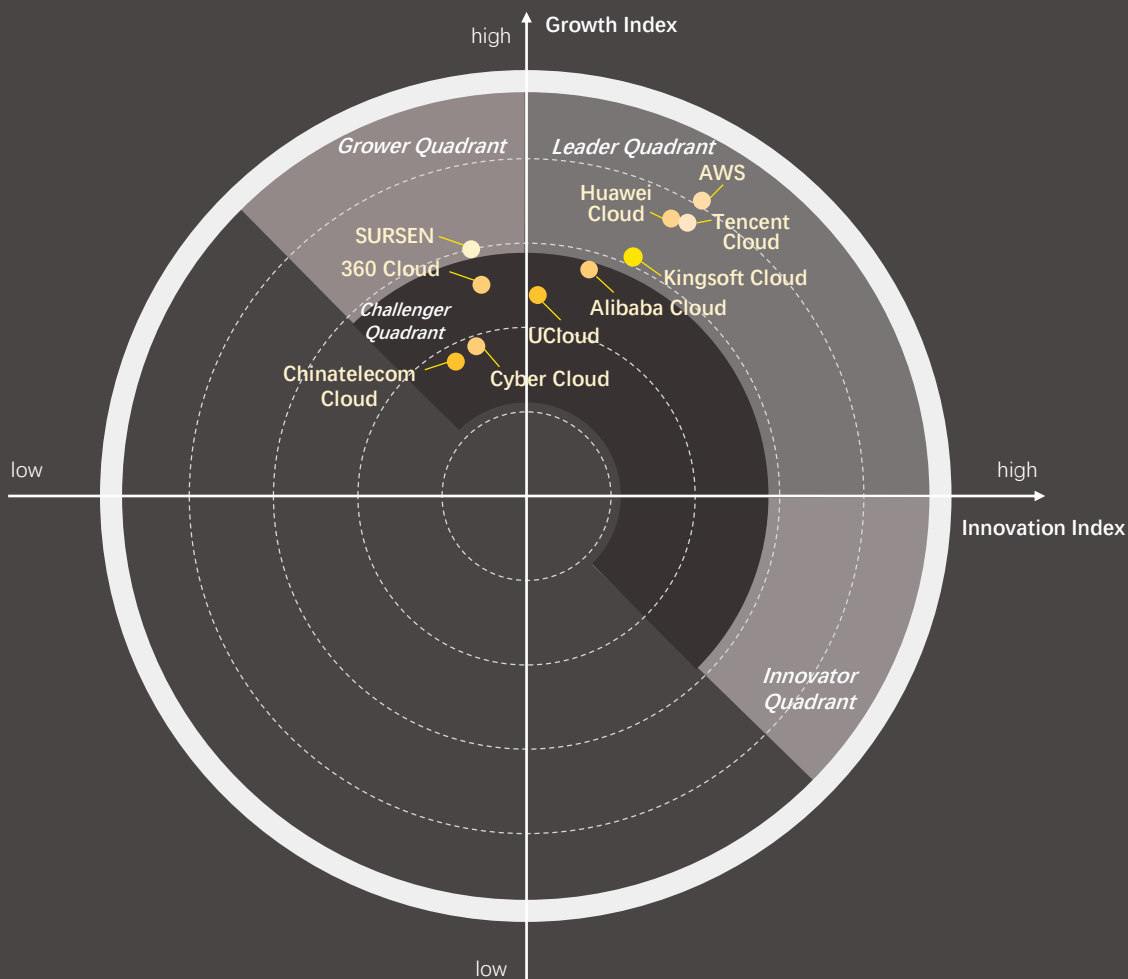
Note: The circle corresponds to the score from low to high according to the logic of increasing from inside to outside. Competitiveness is represented by "innovation index"and "growth index".

Gaming Cloud Service market in China is gradually growing. The conclusions of this report about the comprehensive competitiveness of Gaming Cloud Service in each of the competitive subjects are only applicable to the market development at this stage.

❑   **Y-axis represents"Growth Index":**

Measure the growth ability of competitors in Gaming Cloud Service. The higher the position, the greater the performance growth potential is.

❑   **X-axis represents "Innovation Index":**

Measure the innovation ability of competitors in Gaming Cloud Service. The more to the right of the position, the greater the innovation ability is.

•   The ranking results in this report are for reference only and does not represent the most realistic competitive landscape in the market.

Leader：

Amazon Web Service (AWS)

❑ **Leader Advantage**

AWS provides more than 200 basic services relating to computing, storage, database, network, data analysis and other services in the field of gaming cloud services, and combine with business experience and practical scenarios of game enterprises to provide solutions for the game industry. AWS gaming cloud solutions cover the whole life cycle of game development and deployment as well as online operation, helping game customers to improve the efficiency of game production and online operation. Also in terms of solutions, AWS provides game cloud services, open source solutions, partner solutions, cloud native development, back-end hosting services, game security, online operation, game analytics, AI/ML and other various solutions for game developers and publishers, helping the game industry liberate creativity and improve efficiency.

AWS: Mapping of products and solutions for gaming cloud services
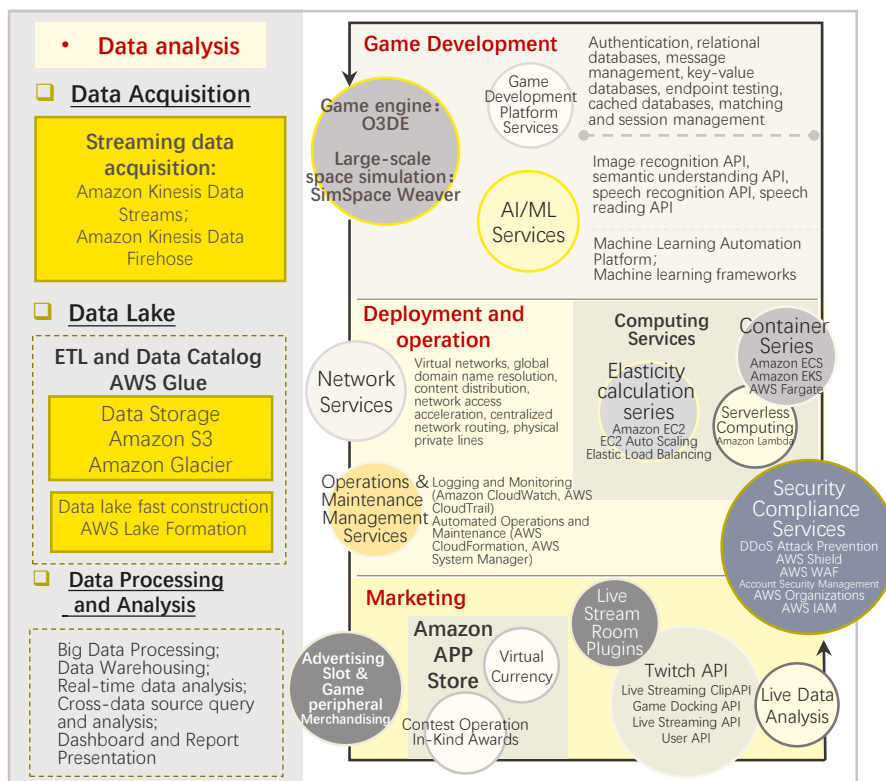
❑ **Focuse on infrastructure security and stability; Independently research efficient server chip to secure customer data.**

AWS provides business support for global gaming customers based on leading infrastructure capabilities, secure IT value and resilient operation capabilities. With increasing strictness in worldwide privacy protection, AWS focuses on infrastructure construction and data security for customers in the gaming industry, providing guarantees for game service operation and user data compliance. In 2022, AWS released Graviton3E high-performance server chip, providing higher floating-point computing power and more cost-effective solutions for game operation.

❑ **AWS solutions relating to backend automation greatly reduce the cost of game operation and game maintenance, assisting more efficient game content innovation.**

AWS builds scaling tools and serverless, containerized game backend architecture for the backend. In 2022, AWS helps game industry customers such as NUVERSE and Habby to smoothly release their big hits in overseas markets. Back-end automated building and scaling solutions help game industry customers reduce back-end construction complexity and operation and maintenance costs, and also reduce the cost of game innovation. In the field of game content innovation, AWS accelerates game content iteration through AI/ML advantages and partner solutions. In 2022, AWS releases SageMaker JumpStart to provide game industry customers with the ability to train models using popular data at lower threshold.

Leader：

Amazon Web Service (AWS)

❑ **Operation data analysis solutions and game community operation and maintenance solutions provided by AWS help Chinese game enterprises promote game efficiently in overseas market:**

AWS provides Chinese game enterprises with mature solutions for community maintenance and player data analysis in the field of game distribution and operation. AWS provides data analysis solutions to help start-up game enterprises quickly establish efficient data analysis platform, and provide senseless data collection, storage and calculation services during the expansion period, and ensure accurate data transfer back to central office while ensuring low latency. AWS provide game community operation and maintenance solution to help game enterprises reduce operation risks, adapt to overseas markets and greatly lower labor and time costs.

❑ **AWS provide open source free development tools to help game meta-universe content development and promote collaboration among global developers:**

Concerning game meta-universe creativity, AWS launched the open source 3D engine O3DE in 2021 in cooperation with the Linux Foundation to provide open-source free and comprehensive tool chain and highly modular 3A-level content development tools for game related meta-universe content innovators. When it comes to game development on cloud, AWS provides solutions such as virtual workstations, rendering farms and shared storage. AWS also provide the game industry worldwide with new solutions to improve global collaboration.

Amazon Web Service (AWS)

2022 China Gaming Cloud Service Market Frost Radar Ranking Notes

✓Amazon Web Services Ranked 1st in Growth Index in Frost Radar
✓Amazon Web Services Ranked 1st in Innovation Index in Frost Radar

Amazon Web Services ranked #1 in Growth Index, scoring highest in the following metrics :

■ **AWS scores highest in gaming cloud stability, link quality, and elastic storage:**

○ AWS relies on high network availability to provide game companies with multiple availability zones and application partitioned architecture, and provides high network quality with low latency and packet loss overall, while improving storage resource planning efficiency for game companies and supporting instant storage invocation to accelerate game releasing process.

■ **AWS scores highest in improving elastic scaling and resource allocation:**

○ AWS supports automatic instance scaling, and can provide gaming customers with a multi-instance simultaneous on-off solution, and can automatically scale instance capacity according to gaming customers' requirements, and would automatically add or remove instances according to demand.

■ **AWS scores highest in ensuring CDN node stability and increasing CDN node rate :**

○ AWS relies on automated network mapping and intelligent routing capabilities to deliver data through globally covered CDN node deployments, reducing latency and improving security through traffic encryption access and control. In addition, AWS provides free regional edge caching to reduce the burden of operations and maintenance.

■ **AWS scores highest in gaming cloud data backup and security and in helping game companies from China go overseas :**

○ AWS provides online backup and instant recovery services for game customers based on its mature database capabilities, allowing users to centralize cross-service backup management; AWS provides long-term overseas support for many Chinese game vendors with its worldwide deployed security compliance and security audit services.

Amazon Web Services ranked #1 in Innovation Index, scoring highest in the following metrics :

■ **AWS scores highest in integrating AI/ML in gaming cloud and helping game customers build large games. :**

○ AWS helps Chinese game customers improve creation efficiency in all aspects by integrating AI/ML solutions in material generation, opinion analysis, level balancing, and content personalization, and helps global teams build production pipelines on cloud via virtual workstations within Amazon Nimble Studio.

■ **AWS scores highest in integrating game PaaS functions and game business data analysis and processing**

○ AWS connects PaaS services such as computing, storage, database, data analysis and machine learning to provide native game industry solutions for game customers, and relies on Amazon EMR cloud-based big data solutions to support interactive data analysis. AWS also builds game data lake and data warehouses through Amazon S3 and Amazon Glue to help game design and operation.

■ **AWS scores highest in supporting automated operations and maintenance and back-end elastic scaling for gaming operations:**

○ AWS relies on Amazon GameLift, a specific game server hosting technology, to support massive multiplayer online game deployment, automated operations and scaling. AWS also support back-end elastic scaling, and can host millions of players online matchmaking.

■ **AWS scores highest in in global gaming advertising and global live gaming platforms :**

○ AWS provides display-based promotion and brand-based promotion services for game advertisers through Amazon Advertising, and provides cross-channel resources through video advertising and customized advertising solutions, and also helps game customers make decisions by relying on demand optimization platform DSP and diversion insight capabilities.

Leader：

Tencent Cloud

❑ **Leadership Advantages**

Tencent Cloud operates 70 availability zones in 26 geographic regions around the world, deploying over 1 million servers, 2,800 acceleration nodes, EB-level data storage, 200T bandwidth reserves, and owns over 400 domestic and international authoritative certifications. Based on originally accumulated capabilities in technological innovation, R&D, operation and maintenance in the game industry and its extensive global market business layout, Tencent Cloud provides assistance to game enterprises in various aspects such as user growth, game R&D and operation efficiency improvement, and game export. In the future, Tencent Cloud would continue to provide game industry with gaming cloud solutions including game basic resources, game deployment, game development, game big data and marketing, and game experience optimization, covering the entire game chain, simplifying the game R&D and operation process, helping game enterprises focus more on content creation and game design, and generally promoting the development of China's game industry.

Tencent Cloud: Panoramic view of gaming cloud service solutions
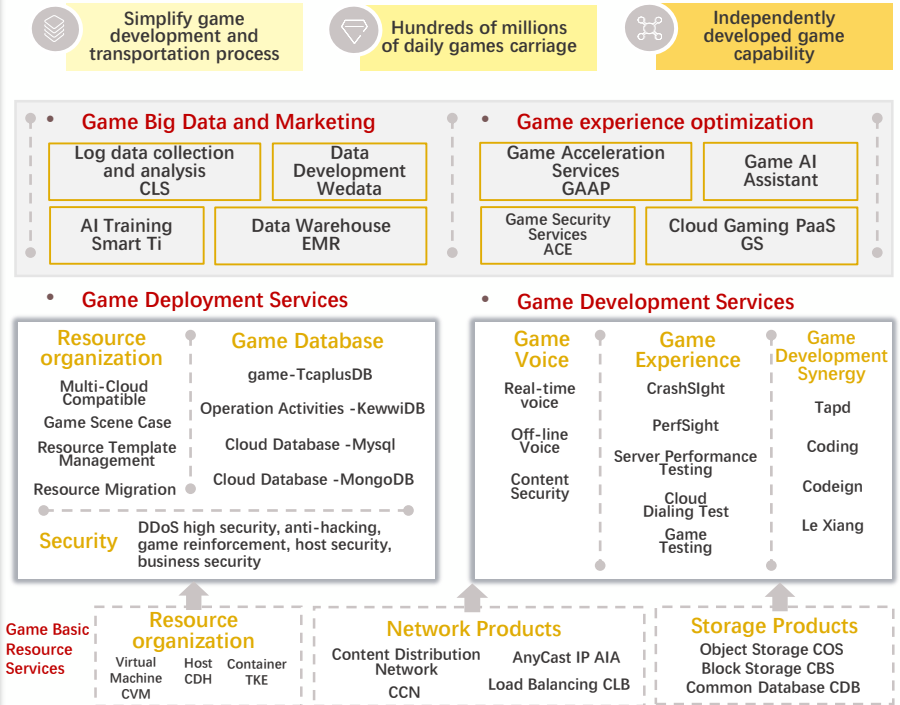
❑ **Tencent Cloud facilitates innovation for virtual world gaming**

Tencent Cloud released innovative interactive solution for immersive virtual worlds, covering virtual human, virtual space, virtual props, live action capture, live interaction and other capabilities, relying on independently researched AI facial action capture and model-driven capabilities to ensure player experience on multiple platforms such as iOS, Android, MacOS, Windows, etc. In addition, through high-definition sound quality, low-latency voice services, environmental reverberation, 3-D space voice, range voice and other functions, Tencent Cloud greatly enhanced the realism under multiplayer interaction scenario and reduced costs by using technologies such as transmission audio frames.

❑ **Tencent Cloud greatly improves game data storage efficiency, ensures high performance, low cost and convenient operation and maintenance**

Tencent Cloud TcaplusDB is specifically designed for game business, using distributed architecture, hot and cold data exchange and other technologies to meet up with requirements from game business, such as high throughput and low latency, and lossless expansion and contraction under non-stop service. KeeWiDB is a distributed KV database developed by Tencent Cloud, which is compatible with Redis protocol, and uses persistent memory technology to support sub-millisecond response latency, hot and cold data storage. And also, this database supports 100TB storage, data persistency, and high-performance read-and-write to help enterprises reduce costs and increase efficiency.

❑ **Great upgrades to GME game voice engine to enhance game immersion experience**

Tencent Cloud upgraded the GME game immersive voice solution and voice AI capabilities at the end of 2021, providing real-time voice and voice messaging services for game scenarios. Combining GME with Wwise, the industry's leading sound engine, Tencent Cloud jointly created a solution to improve the fitness between voice and game scenarios, and relied on voice AI capabilities to achieve voice change effects to enhance the level of fun and social interactive effect of games.

❑ **WeTest improves game quality and helps game companies build high-quality games**

WeTest quality management platform provides full lifecycle quality assurance, performance optimization, and operation monitoring services for game business, with capabilities covering compatibility testing, stress testing, performance tools, security testing, remote debugging, and many others. WeTest aim to build a comprehensive security protection system for game business.

❑ **Tencent Cloud provides one-stop cloud game PaaS base to help put cloud game into practice**

Tencent Cloud launched Game Streaming, a cloud game PaaS base, combined with a lightweight and stable all-end SDK to provide a one-stop "console games + mobile game" PaaS solution for cloud game developers.

❑ **ACE game security service provides full-scene, full-cycle and full-link security capabilities**

Tencent Cloud launched Anti-Cheat Expert, a game security product, to provide users with an industry-grade game security system which comprehensively covers scenarios such as anti-extrusion, reinforcement, content security, and economic security, ensuring full-scene, full-cycle, and full-link security solutions.
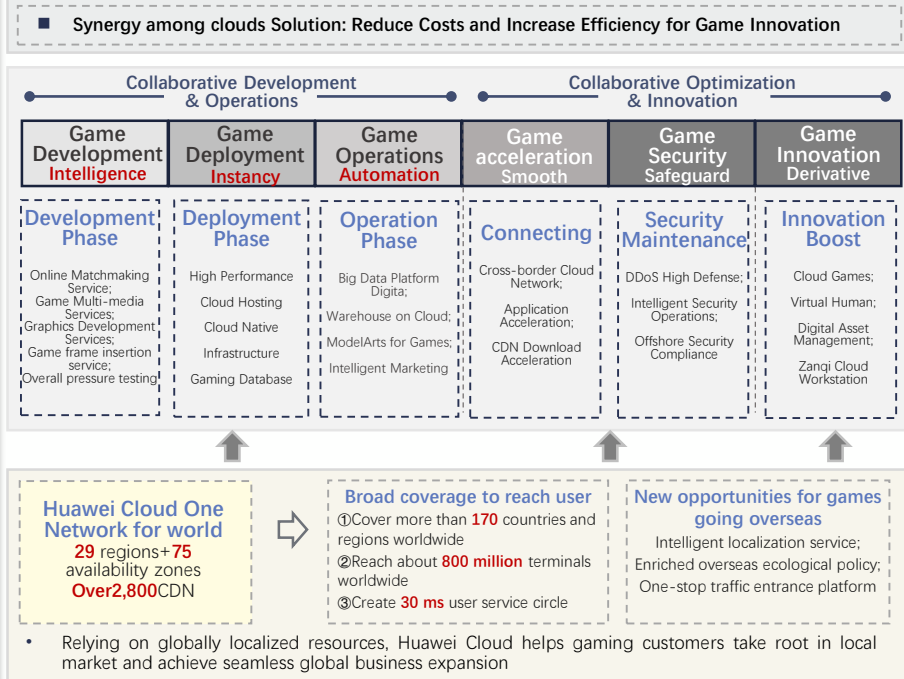
Leader：

Huawei Cloud

❑ Leader Advantage

Huawei Cloud relies on stable and secure cloud services and technological innovation to help game industry create high-quality games, providing one-stop cloud services concerning key aspects such as game development, deployment, operation, acceleration, security and innovation. The computing enhanced cloud host innovated by Huawei cloud can steadily carry ten million players to battle; and the storage and calculation separation game database of Huawei cloud can guarantee the concurrent writing and querying of ten million data during the peak of game business; also, the compatible open source enterprise level big data platform helps refine the operation of game business. Huawei cloud provides the highest T-level protection bandwidth for all kinds of DDoS attacks to guarantee the continuous stability of game business. In addition, concerning the cloud-based mobile game solutions and the cloud gaming solutions, Huawei Cloud supports AOSP9 and Vulkan cross-platform graphics API set to meet the requirements of 3A games.

Huawei Cloud: Game cloud service solution mapping

■ Synergy among clouds Solution: Reduce Costs and Increase Efficiency for Game Innovation

Collaborative Development & Operations | Collaborative Optimization & Innovation

| Game Development **Intelligence** | Game Deployment **Instancy** | Game Operations **Automation** | Game acceleration **Smooth** | Game Security **Safeguard** | Game Innovation **Derivative** |

| Development Phase | Deployment Phase | Operation Phase | Connecting | Security Maintenance | Innovation Boost |

Online Matchmaking Service; Game Multi-media Services; Graphics Development Services; Game frame insertion service; Overall pressure testing | High Performance Cloud Hosting Cloud Native Infrastructure Gaming Database | Big Data Platform Digita; Warehouse on Cloud; ModelArts for Games; Intelligent Marketing | Cross-border Cloud Network; Application Acceleration; CDN Download Acceleration | DDoS High Defense; Intelligent Security Operations; Offshore Security Compliance | Cloud Games; Virtual Human; Digital Asset Management; Zanqi Cloud Workstation

Huawei Cloud One Network for world
29 regions+75 availability zones
Over2,800CDN

Broad coverage to reach user
①Cover more than **170** countries and regions worldwide
②Reach about **800 million** terminals worldwide
③Create **30 ms** user service circle

New opportunities for games going overseas
Intelligent localization service;
Enriched overseas ecological policy;
One-stop traffic entrance platform

- Relying on globally localized resources, Huawei Cloud helps gaming customers take root in local market and achieve seamless global business expansion

❑ Synergy among clouds to improve R&D efficiency and to accelerate growth in collaboration with users

The deeply combined capabilities from Huawei Cloud services and Huawei terminal cloud services provide a set of closed-loop application ecology for game enterprises, including development and testing tools, operation tools and distribution tools. Along with the combined effect, the Petal Gaming Services utilize Huawei's accumulation on hardware technology and advantages in channel data support to provide lightweight end-side development and testing tools for game companies, including online matchmaking, game multimedia, graphics development, game frame insertion, full-link pressure testing, etc., hence to improve R&D efficiency.

❑ Accelerate technological innovation and build high-quality games with game workshops and enterprises

The four main solutions from Huawei Cloud help enterprises to efficiently deploy and stably run boutique games. The computing enhanced cloud host innovated by Huawei provides 10 million level network forwarding, and can carry 10 million level players simultaneously under scenarios of online game battle. Concerning the game database, Huawei Cloud rely on GaussDB (for Redis) storage and calculation separation architecture to ensure the concurrent writing and querying of 10 million data during business peaks. Also, Huawei Cloud provides enterprise-level big data platform to help game companies improve player retention rate based on operation and maintenance-free Serverless big data services, while reducing TCO by 30%. Concerning gaming cloud security, Huawei cloud carries out comprehensive stress testing, risk exclusion, expert team on-site support to guarantee the smooth launch of new games, and protects game security based on T-level high defense.

❑ **Relying on globally accumulated local resources, Huawei Cloud provide multi-faceted game overseas services for game enterprises**

By integrating terminal cloud and partner capabilities, Huawei Cloud provides globally unified application distribution and operation services for game teams who go overseas, and can reach 800 million terminal users worldwide. Based on more than 20 years of local market resource accumulation, Huawei Cloud covers 170+ countries and regions, combining global compliance and local operation experience and local ecology to effectively support game enterprises going abroad.

❑ **Huawei Cloud Activate digital productivity and promote industrial upgrading**

Regarding to scenarios such as virtual human and digital asset, Huawei Cloud provides virtual human service and supports single-camera generated intelligent vision and accelerates production efficiency through AI rendering to further empower virtual human generation, intelligent interaction and video production. When it comes to digital content production and editing, users can realize one-stop workflow of cloud production, cloud rendering, and cloud storage/composition based on Zanqi Cloud workstation powered by Huawei Cloud. Zanqi Cloud workstation could also enhance color lossless 4K HD display and end-to-end 100ms low latency. In terms of digital content management, Huawei Cloud supports simultaneous creation of digital assets on the chain at a frequency of 100,000 times/second. Based on independent digital asset chain, Huawei Cloud realizes full lifecycle management of digital asset identification, distribution, and circulation.

Methodology

◆ Frost & Sullivan has conducted in-depth research on the market changes of 10 major industries and 54 vertical industries in China with more than 500,000 industry research samples accumulated and more than 10,000 independent research and consulting projects completed.

◆ Rooted on the active economic environment in China, the research institute, starting from data management and big data fields, covers the development of the industry cycle, follows from the enterprises' establishment, development, expansion, IPO and maturation. Research analysts of the institute continuously explore and evaluate the vagaries of the industrial development model, enterprise business and operation model, Interpret the evolution of the industry from a professional perspective.

◆ Research institute integrates the traditional and new research methods, adopts the use of self-developed algorithms, excavates the logic behind the quantitative data with the big data across industries and diversified research methods, analyses the views behind the qualitative content, describes the present situation of the industry objectively and authentically, predicts the trend of the development of industry prospectively. Every research report includes a complete presentation of the past, present and future of the industry.

◆ Research institute pays close attention to the latest trends of industry development. The report content and data will be updated and optimized continuously with the development of the industry, technological innovation, changes in the competitive landscape, promulgations of policies and regulations, and in-depth market research.

◆ Adhering to the purpose of research with originality and tenacity, the research institute analyses the industry from the perspective of strategy and reads the industry from the perspective of execution, so as to provide worthy research reports for the report readers of each industry.

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