Solution Brief

Kingsoft Cloud Accelerates CDN and Improves Performance with Intel® QAT

As a global high-quality cloud service expert, Kingsoft Cloud Holdings Limited ("Kingsoft Cloud") provides a reliable cloud computing platform. To meet users' demand for small file service processing and provide high-speed content delivery network (CDN) services, Kingsoft Cloud enables cryptographic computing software offload at the hardware level with Intel® QuickAssist Technology (QAT). QPS performance is greatly improved when compared with software that utilizes the CPU, along with dramatic cost savings in CDN services.

"Technologies such as 5G, AI and IoT have given rise to new applications and brought about new requirements for CDN services. Kingsoft Cloud will harness its CDN strategy of 'AI to upper layer, edge to lower layer' and continue to integrate edge computing, AI and other new technology capabilities. Amidst the implementation of the new strategy, we will partner more closely with Intel and leverage innovative technologies such as QAT to improve the performance of CDN applications in terms of data processing efficiency and stability, while improving the hardware utilization and reducing TCO."

– Zong Jie
General Manager of Kingsoft Cloud CDN and Video Cloud Product Center

Challenge: CDN data encryption and decryption impose huge performance pressure

Today, more and more products and services are delivered via the Internet, thus bringing agile services to more users. However, the network traffic, load, and geographical area of each node can significantly affect the content delivery speed. This presents a call for a CDN acceleration solution to resolve network congestion and improve the website responsiveness to users. With the help of servers deployed in various locations, CDN allows users to get the content they need close to them and alleviate network congestion through load balancing, content delivery, scheduling and other functions of the central platform.

With network security becoming increasingly important and network environment becoming increasingly complex, requests using Transport Layer Security (TLS) protocols such as HTTPS (Hyper Text Transfer Protocol over Secure Socket Layer), HTTP2.0, QUIC (Quick UDP Internet Connection), etc. are more and more common in web services. The TLS protocol provides connection security with two main features: private and reliable. It uses asymmetric encryption algorithms for authentication and key negotiation, and symmetric encryption algorithms use negotiated keys to encrypt data and verify the integrity of data based on a hash function.

Along with the evolution of network attack technologies, ISPs now tend to adopt more advanced encryption methods. This greatly increases the decryption difficulty and also brings about dramatic cryptographic computing workloads on the server side. From the industry's perspective, more than 50% of services are transmitted in ciphertext and hence a large amount of symmetric and asymmetric cryptographic computing is required. This means that a large amount of CPU resources will be consumed, especially CPU resources for asymmetric encryption and decryption.

Since data encryption and decryption consume a lot of CPU resources, HTTPS and QUIC services may cause high latency for user access under the same hardware conditions, which affects user access experience. To reduce latency, one possible way is to increase the investment in cloud

server resources, but this approach will inevitably come with huge cost pressure. It is not a cost-effective choice for users.

Due to architectural constraints, general-purpose CPUs cannot meet the performance requirements of dense TLS protocol cryptographic computing, so dedicated accelerator cards now become the most cost-effective and practical choice.

Solution: Kingsoft Content Delivery Network based on Intel® QAT

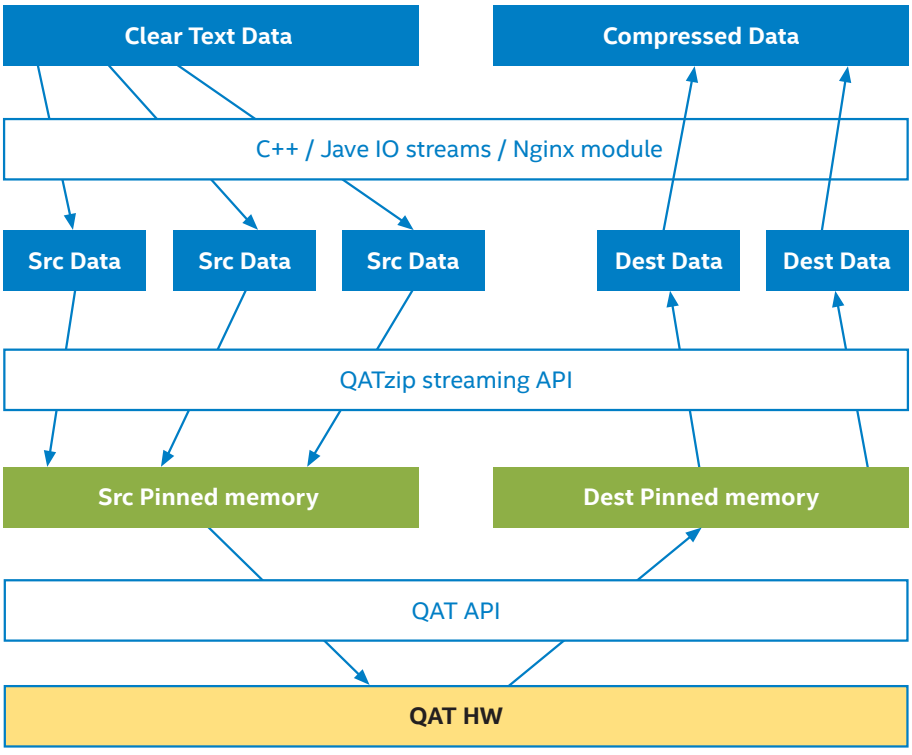
Kingsoft Content Delivery Network ("KCDN") is a distributed network consisting of server clusters of edge nodes distributed in different regions, which distributes user content to edge nodes, effectively resolves the issue of network congestion, and improves the website responsiveness and availability to users. KCDN provides download acceleration services (page acceleration, on-demand acceleration, download acceleration, etc.), and live streaming acceleration services (event live streaming, social live streaming, mobile game live streaming, show live streaming, etc.).

To address the performance bottleneck caused by the large amount of cryptographic and compressed computing in the CDN services for HTTPS, HTTP2.0 and QUIC, Kingsoft Cloud utilizes Intel QAT for acceleration.

Intel QAT is a hardware accelerator developed by Intel for network security and data storage. Intel QAT provides data security and compression acceleration capabilities to improve performance on Intel architecture-based applications and platforms. For network security applications, Intel QAT supports a variety of symmetric data encryption (such as AES), asymmetric public key encryption (such as RSA, elliptic curve, etc.) and data integrity (SHA1/2/3, etc.) algorithms to accelerate operations such as data encryption, decryption and digital signature.

The Intel QAT is adapted for Nginx, a high-performance HTTP and reverse proxy web server that also provides IMAP/POP3/SMTP services. By enabling asynchronous mode, Nginx is able to reduce waiting through parallel processing, achieving the required performance and shortening application response times while consuming fewer system resources.

Intel QAT also boasts powerful compression acceleration capabilities and provides synchronous compression APIs accelerated by QAT. It supports stateless concurrent compression/decompression mode,



stream processing mode based on QAT asynchronous APIs, thread-safe compression APIs, and zero-copy mode based on physically contiguous address memory. Intel QAT can consolidate multiple small data compression/decompression requests into one QAT hardware request to achieve lower CPU usage and higher throughput.

Kingsoft Cloud's CDN services are optimally powered by Intel QAT, which are invoked in asynchronous mode to reduce the overhead of context switching between threads and load shifting costs, thus significantly improving performance.

Benefits: CDN performance has been greatly improved

With Intel QAT, Kingsoft Cloud can offload the asymmetric and symmetric cryptographic workloads from the CPU to the hardware accelerator, thus significantly reducing the workloads of the CPU. Specifically, the Intel QAT achieves the following benefits:

- **Dramatic performance increase:** In a test, Kingsoft Cloud found that the CPU workloads are reduced in a way that also boosts overall system performance, because Intel QAT offloads cryptographic computing workloads from the hardware level. The test suggested that the use of Intel QAT resulted in a significant increase in the query per second (QPS) rate of a single node of the system when compared with a software solution that utilized the CPU.
- **Effectively controlled TCO:** With the improved performance of single node processing based on the existing IT architecture, Kingsoft Cloud is able to meet more CDN services requirements for cryptographic performance without adding server clusters or making disruptive changes to the existing system environment, and the TCO is effectively controlled.
- **Supporting more services:** Intel QAT can not only be applied to the cryptographic scenarios of HTTPS, HTTP2.0, QUIC and others, but also can meet a wider range of performance increase requirements. It helps Kingsoft Cloud further improve its performance and provide more cost-competitive services to users.

Outlook: Kingsoft Cloud and Intel will cooperate in performance optimization for small file cloud services

CDN acceleration is a typical resource acceleration service, and it needs to store and process a large amount of files within 100KB. Particularly, HTTPS, HTTP2.0, QUIC and other applications involve a large amount of computing power for encryption, decryption, compression and decompression tasks, which will consume a lot of hardware resources. Cloud services designed for traditional scenarios may suffer from slow retrieval and sluggish response under the pressure of massive small files, which will affect user experience.

Intel QAT has been proven to improve performance in application scenarios such as web access, data security and data compression, and to increase deployment flexibility and security. Kingsoft Cloud is working with Intel to promote the use of Intel QAT in more small file scenarios to accelerate data processing and improve hardware resource utilization, thus providing users with more cost-effective cloud services.

About Kingsoft Cloud

Founded in 2012, Kingsoft Cloud is the leading cloud service provider in China. Since establishment, Kingsoft Cloud has been devoting to providing customers with safe, reliable, stable and high-quality cloud computing services worldwide. It has developed a comprehensive and reliable cloud platform consisting of extensive cloud infrastructure and solutions across many industries, such as government, finance, AIoT, healthcare, industrial engineering, media, video, game, education and Internet. These solutions integrate with AI, big data, IoT, blockchain, edge computing, and AR/VR technologies.

About Intel

Intel (NASDAQ: INTC), as an industry leader, creates technologies that change the world, promotes global progress and enriches life. Inspired by Moore's Law, we are continuously committed to advancing semiconductor design and manufacturing to help our customers meet the most significant challenges. By integrating intelligence into the cloud, network, edge, and various computing devices, we unleash the potential of data and help businesses and society become better. For more information on Intel's innovation, please visit Intel China News Center (newsroom.intel.cn) and the official website (intel.cn).