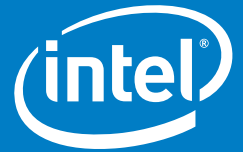


Case Study

Intel® QuickAssist Technology
Content Delivery Network (CDN) Acceleration



Working Together to Build a High Efficiency CDN System for HTTPS

Intel Corporation and Wangsu Science & Technology Jointly Optimized the Intel® QuickAssist Technology (Intel® QAT) Acceleration Solution to Improve CDN Performance and Increase Cost-Effectiveness

Testimony

"Enabling HTTPS to have better performance in terms of security is one of the development directions that web services will take in the future, which gives us more space for innovation in our CDN services, while putting forward higher requirements on back-end infrastructure performance. During the course of our cooperation, not only did Intel provide us with high performance acceleration technology solutions, but through the close collaboration between the engineers from both sides, we solved the compatibility problems which arose during the solution implementation and achieved our expected acceleration results. We were also able to effectively lower the TCO of the system and achieve higher cost-effectiveness. This also shows that while facing the challenges of business innovation, collaborative development can be used to provide greater momentum for IT upgrades."

—Li Dong, Vice President
Wangsu Science & Technology

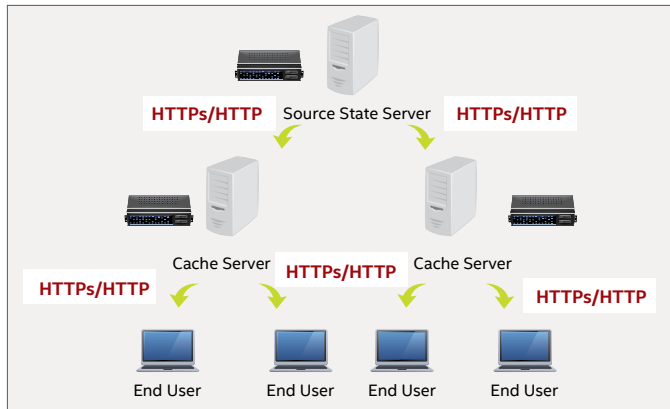
Wangsu Science & Technology* is a leading Internet business platform provider in China and mainly provides content distribution and acceleration, server hosting, leasing, and other Internet business platform solutions to its clients. It is the largest CDN and Internet data center (IDC) integrated service provider in China. To further improve the acceleration capabilities of Hypertext Transfer Protocol Secure (HTTPS) in CDNs and reduce the stress on back-end infrastructure, Wangsu Science & Technology and Intel jointly developed an acceleration technology solution based on Intel® QuickAssist Technology (Intel® QAT). When compared to host-based software, the solution improved performance by over sevenfold and significantly reduced the costs of upgrading CDN systems.

Background

As the Internet industry rapidly develops, and as the value of data assets continues to rise, users care more about web security than ever before. The popularity of HTTPS, which provides authentication and encrypted communication methods, has also increased rapidly. Similar to HTTP, when web service providers offer HTTPS service, they are finding that the network traffic, load, location of the various nodes, and other factors all greatly affect content transmission speeds. Web service providers urgently need a CDN solution applicable to HTTPS to resolve the problem of Internet congestion and to increase the response speeds for website user access. At the same time, web service providers are also finding that HTTPS reduces user access speeds and increases the consumption of the computation resources in the web servers. It makes service providers more attentive to HTTPS-oriented CDN to ensure better user access experiences.

To satisfy the performance requirements of web service providers, Wangsu Science & Technology designed the CDN service that supports HTTPS, as shown in Figure 1, but problems remain. The CDN service with HTTPS enabled consumes a lot of resources, which significantly affects the system performance. The traditional software solution cannot support so many concurrent HTTPS connections. The only way to improve HTTPS capacity is to expand the CDN cluster. Obviously, this brings tremendous pressure in terms of cost control. Therefore, CDN providers, including Wangsu Science & Technology, are constantly searching for more efficient solutions.

Figure 1: Wangsu Science & Technology CDN System Architecture



Challenges

Further improving CDN efficiency

Traditionally, the CDN system uses a host-based software solution for HTTPS processing. Although these types of models applied relatively simple technology, their efficiency and performance are not ideal. Wangsu Science & Technology used the Squid* solution to get better performance. Squid is an open-source solution generally used for providing high-speed web access cache and is widely used in the CDN field. However, many accelerator cards are not compatible with the Squid solution, and asynchronous acceleration mode cannot be used, which greatly reduces the acceleration impact.

In this context, Wangsu Science & Technology has two choices. The first option is to abandon Squid technology and choose Nginx* or other solutions. However, this would shake up the entire foundation of the CDN system, and the costs for replacement would be too high. It could also lead to unexpected instability and other issues. The second option is to make accelerator cards compatible with Squid. This requires joint research and development with manufacturers, and close cooperation to accurately observe the CDN applications.

CDN systems face enormous cost pressures

Currently, Wangsu Science & Technology has a market share of over 40 percent in China's CDN market, and fluctuations in the cost of CDN systems greatly affects the total cost of ownership

(TCO) of Wangsu Science & Technology. If the system resources in a single node cannot afford the current workload, the only option is to expand the CDN cluster and add server nodes. This puts a lot of pressure on hardware procurement costs. In today's extremely competitive CDN market in China, Wangsu Science & Technology wants to greatly improve HTTPS performance without adding additional server nodes. They want to achieve the greatest performance while spending the least amount of money. This would clearly improve their core competitiveness.

Dealing with more requirements for data acceleration

Wangsu Science & Technology is an Internet business platform provider and provides users with outstanding Internet business support services. Many of the services involve CDN and other data acceleration requirements. Wangsu Science & Technology wants to use the success of this project and expand the solution to HTTPS acceleration.

Solution

With the ever-increasing requirements for HTTPS acceleration, Wangsu Science & Technology started model selection, research, and development of the CDN acceleration solution. Intel® QuickAssist Technology (Intel® QAT) caught the attention of Wangsu Science & Technology. Intel® QAT accelerator cards have dedicated encryption/decryption technology and will greatly increase the HTTPS connections per second (CPS) supported by servers.

As described earlier, a major problem surfaced during the preliminary discussions. In addition to requiring the installation of the OpenSSL* library, Intel® QAT accelerator cards also require the installation of libraries that support asynchronous calls on the application. Intel® QAT accelerator cards currently only have official patches for Nginx, which enables the accelerator card to use asynchronous call functions. However, Wangsu Science & Technology has always used the Squid solution, which is otherwise incompatible with Intel® QAT accelerator cards. Therefore, Squid could not use the desired asynchronous call functions. Wangsu Science & Technology and Intel conducted tests and demonstrations with these factors in mind to quantify the impact of asynchronous mode support.

Wangsu Science & Technology and Intel compared the performance differences between using the synchronous acceleration mode and asynchronous acceleration mode in the Nginx solution environment.

Results showed that for the acceleration system to reach a maximum performance of 40K cps (connections per second) under the synchronous mode, the servers require 256 work processes enabled. In comparison, under the asynchronous acceleration mode, only 20 work processes are required to reach high performance. This represents a significant difference, as shown in Table 1.

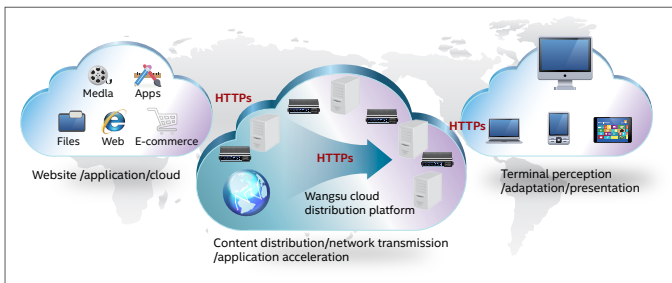
Table 1: Synchronous and Asynchronous Acceleration Performance Comparison

	Work Process	CPS
Synchronous Acceleration	256	38K
Asynchronous Acceleration	20	40K

Test configuration: CPU: Intel® Xeon® Processor E5 v3 Family; 2.40 GHz; Cores and DIMMS 4 GB 2133 MHz x8; Intel® QuickAssist Adapter 8950; SW cat*; Kernel 2.6.32-642.3.1.el6.x86_64; ZOL 0.6.5.3-1; Intel® QuickAssist Technology driver 1.6.

As the test data shows in Table 1, if the Intel® QAT accelerator card is installed without the adaptation, the extremely important asynchronous call function cannot be used, which causes an enormous loss in performance. After detailed discussions between Wangsu Science & Technology and Intel, both parties agreed to jointly develop the acceleration solution to Squid. With this modification to support Squid, Wangsu could accelerate its Squid-based CDN solution using Intel® QAT to provide reliable, high-speed, HTTPS service, as shown in Figure 2.

Figure 2: Schematic for Wangsu Science & Technology's HTTPS Acceleration



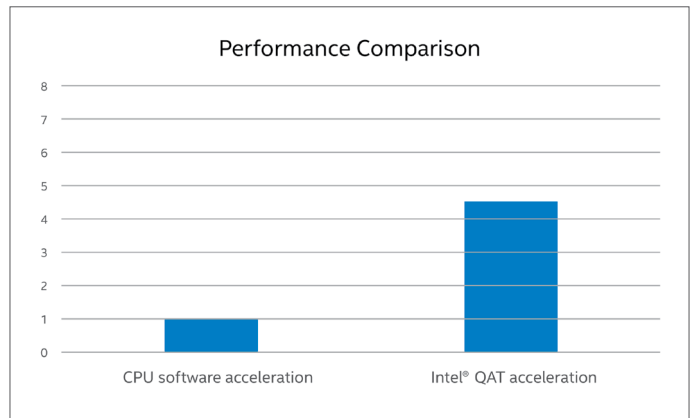
In application, Wangsu Science & Technology and Intel set up a joint research and development team to modify the Squid community version. The modified version supports the asynchronous call model of Intel® QAT to successfully enable the asynchronous acceleration mode to reach expected performance results.

Results

CDN performance improves considerably

After adapting Squid to Intel® QAT, Wangsu Science & Technology ran tests in a laboratory on 2048-bit RSA encryption. The test results showed that Squid could reach up to 1,863 connections per second in a single process. The results show that the Intel® QAT-enabled solution increases performance by an impressive 454.4 percent. In terms of business practices, Wangsu Science & Technology also discovered that Squid could use Intel® QAT to accelerate HTTPS. This results in approximately a 4.5 times performance increase when compared to using CPU software acceleration, as shown in Figure 3.

Figure 3: Performance Comparison (This is a relative performance comparison, with the performance of the software as the baseline.)



Test configuration: CPU: Intel® Xeon® Processor E5 v3 Family; 2.40 GHz; Cores and DIMMS 4GB 2133 MHz x8; Intel® QuickAssist Adapter 8950; SW cat*; Kernel 2.6.32-642.3.1.el6.x86_64; ZOL 0.6.5.3-1; Intel® QuickAssist Technology driver 1.6.

TCO of CDN system effectively controlled

Wangsu Science & Technology and Intel worked together and used a software adaptation approach to solve the major issues in HTTPS acceleration. The solution greatly improves HTTPS acceleration performance and achieves effective control of TCO, without modifying the existing system environment too much and without expanding the server cluster. According to an assessment by Wangsu Science & Technology, deployment of an Intel® QAT acceleration based solution can reduce costs by more than 20 percent. It can also help improve the agility of Wangsu Science & Technology's CDN business and provide more economical CDN services to web service providers.

Providing support for more data acceleration services

After verifying the outstanding results of the Intel® QAT acceleration solution, Wangsu Science & Technology plans to expand the application scope of Intel® QAT technology further and implement HTTPS acceleration for CDNs.

Experience

The establishment and upgrading of a CDN system is a systematic project. Performance needs to be considered as well as whether the system construction and upgrade brings economic benefits. Further, the CDN system must be conducive to improvement in the core competitiveness of services. When developing a construction plan, developers must conduct a detailed evaluation of various solutions according to the application environment. When issues arise, such as compatibility problems, the two sides should collaborate to find a more applicable solution. The most efficient system that minimally affects existing systems should be selected.

After deploying a solution, Wangsu Science & Technology and Intel recommend using CDN as the main basis. In addition, the system should be further optimized to reduce stress on the infrastructure and continue to increase CDN acceleration capabilities.

"Wangsu Science & Technology and Intel's close partnership significantly increased the CDN performance for HTTPS and assisted in the optimization of CDN server clusters. It also sets an example of solving product adaptation problems through joint research and development. Not only does this give a solid foundation for future collaborations between the two sides, it also provides a reference for data acceleration businesses during this age of explosive data growth." —Li Dong, Vice President of Wangsu Science & Technology



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