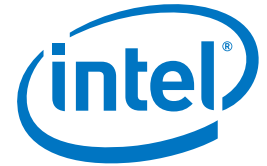


CASE STUDY

Intel® Xeon® Processor E5 Series

Intel® Ethernet 10 Gigabit Converged Network Adapter

Cloud Computing



Boosting DNS reliability with Intel technology

Intel® Xeon® processor E5 series and Intel® Ethernet 10 Gigabit Converged Network Adapter X540 help Beijing Fastweb Technology Co. Ltd.'s CloudXNS* system provide safe DNS service



Beijing Fastweb Technology Co. Ltd.'s (Fastweb) CloudXNS system is an intelligent extended domain name system (DNS) service based on cloud computing. Composed of more than 40 servers, the system offers DNS services for more than 70 large Internet enterprises. To further enhance the system's ability to resist distributed denial of service (DDOS) attacks, Fastweb worked with Intel late last year to install a testing environment based on Intel® Xeon® processor E5 series and Intel® Ethernet 10 Gigabit Converged Network Adapter. This enabled the CloudXNS system to attain great advancements in resisting DNS attacks, improving resistance from 400k QPS to 3.40m QPS.

"Compared to using combined Intel Xeon processor 5500 series and Intel Ethernet Gigabit Server Adapter, utilizing Intel Xeon processor E5 series and Intel Ethernet 10 Gigabit Converged Network Adapter boosted the DNS server's ability to resist DNS attacks by more than eight times over the previous configuration."

Sun Baijie

Product Manager

Beijing Fastweb Technology Co. Ltd.

CHALLENGES

- **Enhance ability of resisting DDOS attack.** Improve CloudXNS system's resistance to security attacks to provide higher quality services to customers.
- **Eliminate bottleneck in network adapter data throughput.** Remove constraints in the data throughput capacity of the CloudXNS system, which uses Intel Ethernet 10 Gigabit Converged Network Adapter
- **Improve processor's computing performance.** Ensure the processor will have the capability to realize DNS resolution in case of DDOS attacks, ensuring users will be provided highly reliable DNS services at all times.

SOLUTIONS

- **Replace existing configuration with the combination of Intel Xeon processor E5 series and Intel Ethernet 10 Gigabit Converged Network Adapter.** Install a DNS service testing platform based on Intel technologies to resist 3.40m QPS DDOS attacks.
- **Enhance network adapter data throughput capacity.** Replacing GbE adapter with 10GbE adapter improved DNS server's data throughput capacity, allowing more DNS requests to pass through the network adapter.
- **Provide sufficient computing capability.** Stronger data throughput also meets the servers need to have a more efficient data computing capability.

IMPACT

- **Provided quality services to users.** Fastweb is now equipped with the capability to provide more reliable and better DNS resolution services for its users.
- **Enabled secure DNS services.** CloudXNS system is now equipped with stronger ability to resist DNS attacks, improving resistance eight times better than the previous configuration and making the network safer and more protected.
- **Enhanced network adapter data throughput and CPU computing performance.** Intel Xeon processor E5 series and Intel Ethernet 10 Gigabit Converged Network Adapter improved the DNS server's data throughput capacity and computing capability.

Cloud computing architecture boosting DNS services

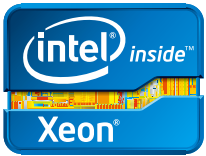
Fastweb's CloudXNS system, based on a cloud computing architecture, not only has a resolution rate two to three times that of the traditional DNS, but also offers some special functions such as reporting, statistics, monitoring, automatic backup, and a Web user interface. With such numerous functions, the system greatly facilitates users' DNS management.

The CloudXNS system can intelligently judge the user's network and resolve the domain names into IP addresses. Moreover, the system can also automatically detect system failure and track the server's running faults, while resolving the DNS resolution request to the servers operating normally. Through these functions, the system is able to extend highly reliable DNS services to its users.

For features like intelligent load balance and intelligent overload diversion through DNS scheduler, as well as the optimization in the software level, Fastweb ensures that the CloudXNS system is equipped with stronger ability to resist DNS attacks than the traditional DNS.

The need for enhanced DNS attack resistance

DNS enjoys an extremely important position in the Internet industry. As the first stop in accessing the Internet, DNS assumes the important responsibility of resolving the domain names to the real IP addresses. If the resolution fails, the user will not be able to access the Internet.



With the help of Intel® Xeon® processor E5 series and Intel® Ethernet 10 Gigabit Converged Network Adapter, Fastweb enhances CloudXNS system's ability to resist DDOS attacks eight times better than the previous system

Fastweb's CloudXNS system, based on the software-level optimization on a cloud computing architecture, has been deploying servers using Intel Xeon processor 5500 series and gigabit Ethernet adapter based on Intel® Ethernet Controller 82576. Using this configuration allowed the system to resist 400k QPS from 80k QPS attack.

"The several DNS safety incidents that happened previously still have an impact on the industry. To avoid such incidents from happening again, we needed to constantly adopt up-to-date technologies to improve our CloudXNS system's capability to resist DNS attacks, and thus ensure highly reliable DNS services for our customers," shares Sun Baijie, product manager at Fastweb.

Ensuring efficient resistance to DNS attacks has thus been a concern for Fastweb. With its existing configuration, there were problems that needed to be fixed for the CloudXNS system to function effectively for its users:

Data throughput bottleneck. Enhancing server NIC data throughput will allow more DNS requests to pass through the network adapter, thus improving the DNS server resolution ability within unit time. In other words, the system is like a large reservoir – the greater the diameter of the inlet pipe, the greater the water inflow.

"Fastweb has realized that the existing CloudXNS system's GbE adapter has constrained the DNS's ability of requesting data to go to the server, as the data amount that any single DNS request passing through the adapter is fixed. We needed then to replace this existing adapter with another adapter of stronger data throughput to help improve the system's DNS resolution ability," explains Sun.

Less computing capability. After the data is transferred to the DNS server through the adapter, the server needs to compute the IP address of a specific server according to certain operation rules and return the IP address to the user. If the data amount into the server is

too large and the server happens to be unable to compute these data, the DNS resolution services will not be achieved normally.

"Our data shows that our existing DNS server, using Intel Xeon processor 5500 series, has sufficient capability to deal with the DNS request data into the server through the Intel Ethernet 10 Gigabit Converged Network Adapter. However, as we needed an adapter with greater data throughput, we also needed to ensure that the server will still have sufficient computing capability to deal with a large amount of data," says Sun.

Eliminating bottlenecks and enhancing computing performance

At the end of 2012, Fastweb worked with Intel to install a test platform for the CloudXNS system. The test was completed in two phases.

In the first phase, the DNS scheduler and a real DNS server still retained the existing Intel Xeon processor 5500 series but the Intel Ethernet Controller 82576 was replaced with Intel Ethernet 10 Gigabit Converged Network Adapter X540. Different amounts of simulated DNS requests were launched to test the data throughput of the new server adapter.

Test results showed that when the server was operating stably and no data packets were dropped, DNS requests reached one million QPS, and the network adapter's average flow was 3Gb per second. Obviously, the new adapter allowed more data to pass. Fastweb was able to increase the frequency of DNS requests to 1.30m QPS, and increase the network adapter's average flow to 4Gb per second.

Fastweb, however, encountered a problem when using this configuration. One to two cores of the scheduler and the real DNS server were 100 percent occupied and, more importantly, a large number of data packets were missing. Sun relates, "The utilization rate of the adapter was less than 50 percent, which means there is greater space for improvement. We figured that a stronger adapter

LESSONS LEARNED

- Intel Ethernet 10 Gigabit Converged Network Adapter is especially suitable for application environments such as a DNS server network, which has intensive data input/output. It allows a larger amount of data flow to pass more efficiently.
- Intel Xeon processor E5 series has excellent computing performance. In the case of intensive DNS requests, it still maintains normal utilization rate, ensuring the stability of the CloudXNS system.
- The data throughput of Intel Ethernet 10 Gigabit Converged Network Adapter and the high performance of Intel Xeon processor E5 series helped Fastweb address the bottleneck in data flow and enhanced the computing performance in the adapter of the CloudXNS system, thus achieving stronger ability to resist DDOS attacks.

would improve the CloudXNS system's DNS resolution ability and a processor with stronger computing capability was also needed"

In the second phase, the original four-core Intel Xeon processors 5500 series were replaced with eight-core Intel Xeon processors E5 series in the scheduler and a real DNS server. The number of simulated DNS requests was unchanged, but the DNS request frequency was increased.

Results showed that when the DNS request was at an average of 3.40m QPS, the flow of the adapter was 9.5Gb per second, while the processor's utilization rate remained low.

"The data throughput of Intel Ethernet 10 Gigabit Converged Network Adapter has been fully utilized, and the super-powerful computing capability of Intel Xeon processor E5 series enhanced the computing capability of the system. These test results have demonstrated the perfect balance between data flow and computing capability that Fastweb needed to boost its DNS server. The ability of resisting DDOS attacks has improved eight times over the previous configuration we were using for the DNS system," shares Sun.

Driven by these impressive results, Fastweb will continue to deploy Intel Xeon processor E5 series and Intel Ethernet 10 Gigabit Converged Network Adapter on its CloudXNS system's servers. In the meantime, it is planning to use a dual-port Intel Ethernet 10 Gigabit Converged Network Adapter or 40Gb adapter to speed up its CloudXNS system.

Find a solution that's right for your organization. Contact your Intel representative, visit Intel's Business Success Stories for IT Managers (www.intel.com/itcasestudies) or explore the Intel.com IT Center (www.intel.com/itcenter).

Test environment	Status	QPS	Outward flow	CPU utilization	Remarks
Intel® Xeon® Processor E5530 (2.4GHz, 4 cores) + 8GB memory + Intel® Ethernet Controller 82576	Stable	400k	1Gb/s	About 50 percent	Adapter bottleneck
Intel Xeon Processor E5530 (2.4GHz, 4 cores) + 8GB memory + Intel® Ethernet 10 Gigabit Converged Network Adapter X540	Stable	1m	3Gb/s	About 40 percent	Normal
Intel Xeon Processor E5530 (2.4GHz, 4 cores) + 8GB memory + Intel Ethernet 10 Gigabit Converged Network Adapter X540	Pressure	1.30m	4Gb/s	1 or 2 cores at 100 percent	CPU bottleneck
Intel Xeon Processor E5-2680 (2.7GHz, 8 cores) + 64GB memory + Intel Ethernet 10 Gigabit Converged Network Adapter X540	Stable	3.40m	9.5Gb/s	About 10 percent	Normal

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