CASE STUDY

High Performance Computing (HPC)
Intel® Xeon® Scalable Processor
Intel® SSD S4500 and D3-S4610 Series

China National Petroleum Corporation Boosts Seismic Processing with Intel® Xeon® Gold Processors

Intel® Xeon® Scalable processors and Intel® SSD DC S4610 series drives create a faster, more I/O efficient cluster

CNPC cluster highlights:

- 256 server nodes
- Intel® Xeon® Gold 6132 processor (19.25M Cache, 2.60 GHz)
- Intel® SSD DC S4500 Series (240GB, 2.5in SATA 6Gb/s, 3D1, TLC)
- Intel® SSD D3-S4610 Series (1.92TB, 2.5in SATA 6Gb/s, 3D2, TLC)

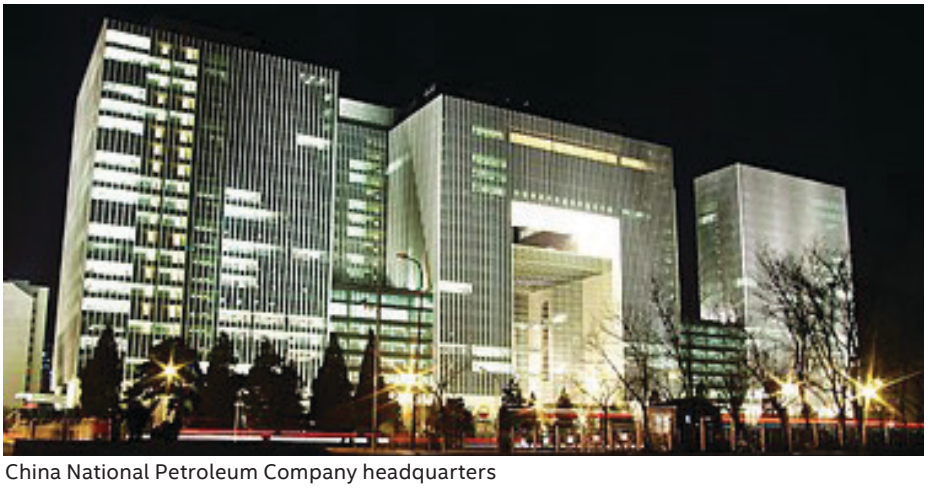
Executive Summary

China National Petroleum Corporation (CNPC) is the world's largest oil company by revenue. Operating as both an oil company and oilfield service provider and with oil and gas assets and interests in over 30 countries, CNPC plays a leading role in China's petroleum industry. Seismic processing consumes much of their supercomputing resources. A recent addition to their High Performance Computing (HPC) cluster accelerates their Pre-Stack Time Migration (PSTM) workload, enabling 40 percent better performance over their previous HPC system.[1]

Challenge

BGP, a CNPC subsidiary, is the flagship company for geophysical activities in China and one of the largest integrated energy groups in the world. They use GeoEast Seismic processing code which requires compute performance and high I/O throughput because of the large quantity of seismic data. CNPC was running their seismic projects on some HPC systems that were five years old, slowing down access to much-needed results.

One particular workload—Pre-Stack Time Migration (PSTM)—writes up to 1.5 GB of data every 1.5 hours to the local storage, while it reads much less data. The computational cycle lasts 360 hours (15 days), writing approximately 360 GB of data during that period to the local drive. Similarly, on the boot disk, the OS writes 17.3 GB and reads 1.83 GB during the entire processing time. Thus, overall time to solution was suffering because of I/O performance with the hourly writing of large quantities of data. They needed both a compute performance boost and a low-cost yet high ROI solution to accelerate PSTM IO.



China National Petroleum Company headquarters

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Solution

A recent acquisition of servers from included 256 nodes with Intel® Xeon® Gold 6132 processors. These Intel® Xeon® Scalable processors offer more cores and higher computing performance overall compared to previous generations of Intel® Xeon® E5 processors. Compared to their older HPC system, the new cluster, with more cores, more vector processing performance from the Intel® Advanced Vector Extensions 512 (Intel® AVX-512), and higher CPU clock speeds, the new acquisition delivered 40 percent more compute performance than their existing cluster.[1]

To address the I/O throughput challenge, they replaced existing spinning, mechanical hard drives with high-performance and highly reliable Intel® SSD DC S4500(boot disks)/ S4610(local disks) Series of drives. These SATA drives were direct replacements for the spinning storage but provided much faster bootup and read and write times. The SSD boot disk enabled 30 percent faster boot time.[1] A faster boot and quicker access to local data storage for both write and read operations accelerated data movement and shortened time to solution, which creates a much more efficient supercomputer.

Fuel prices at a petrol station in Dalian

Result

With a faster, more efficient, HPC cluster, CNPC can get results quicker from their seismic teams. This helps them to better decide on which oil reserves to focus their development efforts.

Solution Summary

CNPC, the world's largest petroleum company by revenue, was challenged with slow compute performance and poor I/O efficiency in their supercomputer running PSTM workloads. By moving to Intel Xeon Gold 6132 processors and replacing spinning hard drives with Intel SSD DC S4500 (boot disks)/ S4610 (local disks) series drives, they were able to improve compute performance by 40 percent and boot servers 30 percent faster.[1]

Where to Get More Information

Find out more about Intel® Xeon® Scalable Processor family at https://www.intel.com/content/www/us/en/products/processors/xeon/scalable.html.

For more information on the Intel® SSD DC S4500 series drives, visit https://www.intel.com/content/www/us/en/products/memory-storage/solid-state-drives/data-center-ssds/dc-s4500-series.html.

Solution Ingredients

- 256 server nodes
- Intel® Xeon® Gold 6132 with 14 cores at 2.60 GHz (3.7 GHz Turbo Boost)
- Intel® SSD DC S4500 series solid state drives as bootable disks
- Intel® SSD D3-S4610 Series (1.92TB, 2.5in SATA 6Gb/s, 3D2, TLC) for local disks

[1] Comparison on January 18, 2019. Tested by CNPC. Previous cluster: Xeon E5-2667v4 (3.2GHZ, 8cores), 128GB DDR4-2400, 2x 300GB SAS (bootable disks), 4x 960G SAS HDD (local disks), RHEL7.2, Geoeast3.0. New Cluster: Xeon 6132 (2.6GHZ, 14cores), 192GB DDR4-2666, 2x S4500 240GB (bootable disks) 2x S4610 1.92TB (local disks), RHEL7.2, Geoeast3.0. Workload was Pre-Stack Time Migration (PSTM).

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