



StorNext & Scalar Series

EDRI of Daqing Oil Field Supercharges its High-performance Computing Clusters

Established in 1964, petroleum research giant Daqing Oil Field Petroleum Exploration and Development Research Institute (EDRI) is comprised of over 1,800 petroleum technical and engineering personnel, including many well-known domestic and international geologists, geophysicists and reservoir engineers.

In Daqing Oil Field's history of exploration and production, the Institute has undertaken thousands of important scientific and research projects. These research achievements have played a significant role in oil and gas exploration as well as production of the Daqing Oil Field. And, for the last 27 years, the Institute has consistently made important contributions to Daqing Oil Field's excellent track record of achieving high and stable yields of 50 million tons per year.

In sum, StorNext has greatly increased our overall data processing efficiency.

Baomin Feng
Technical Expert

To help maintain the Oil Field's track record, and support its strategy of driving long-term and sustainable development momentum, the Institute needed a sophisticated IT backbone. Its Geophysics Service Center (GSC) contains nearly one thousand servers. Many of these are high-performance computing (HPC) servers harnessed in oil field seismic data processing applications. Linux-based HPC clusters are used by the Institute in seismic 3D pre-stack migration time/depth migration processing.

In order to increase the pace of oil and gas exploration, GSC decided to increase its capacity for seismic data processing. This required an expansion of its clustered system. Daqing added high-performance blade server clusters from HP, in

conjunction with SAN storage arrays from Hitachi. The expanded clustered system consisted of over 650 blade servers, 40 I/O servers, high speed 10-gigabit Ethernet network and SAN disk storage. By installing the leading seismic data processing software, the high-resolution data processing and 3D pre-stack migration time/depth migration processing could then be realized. Adoption of the new cluster systems for seismic data processing has led to acceleration of deep-level gas exploration in highly productive areas such as China's Songliao and Hailar Basins.

STORNEXT SOLVES FILE SYSTEM LIMITATIONS

With exponential growth in seismic data computation and disk space, traditional single-node NFS servers could not meet the demands for further data processing. When operating as I/O servers to export the file system among the many computing nodes, a performance bottleneck resulted. In addition, the file system architecture was open to a single point of failure.

The solution to the problem was a combination of Quantum StorNext® File System, StorNext Distributed LAN Client (DLC), StorNext Storage Manager archival system and a Quantum Scalar® i2000 tape library, which provides better equipment optimization, improved resource utilization and greater overall cluster efficiency. In particular, the deployment of shared file systems and rational usage of disk storage space meets the Institute's needs for joint 3D seismic data processing.

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"Our implementation of StorNext has eliminated the performance bottleneck and removed the single point of failure of our previous file system architecture. It has enabled us to dramatically increase our seismic data processing efficiency."

Tiegang Zhang
Chief Engineer

SOLUTION OVERVIEW

- Quantum StorNext File System, DLC and Storage Manager
- Quantum Scalar i2000 tape library
- Blade server clusters from HP
- Hitachi SAN storage arrays

KEY BENEFITS

- Eliminated single point of failure
- Removed performance bottlenecks
- Enabled better equipment optimization
- Improved resource utilization and overall efficiency

CASE STUDY

of failure of our previous file system architecture,” said Zhang Tiegang, chief engineer for EDRI of Daqing Oil Field. “It has enabled us to dramatically increase our seismic data processing efficiency.”

Through the implementation of StorNext, GSC created a large scale seismic processing system consisting of 698 servers, 1,444 CPUs, 10Gbps of new network technology, 576 Ethernet ports, a 400TB fiber channel network disk array and a 600 terabyte (TB) Quantum Scalar i2000 tape library. Each server in the cluster runs the StorNext file system software which allows each server to directly access the shared FC disk at a speed of more than 100MBps.

A total of five sets of seismic data processing software have been installed for the seismic data processing cluster within EDRI of Daqing Oil Field. With traditional shared file systems, application sharing had proved difficult to load balance. StorNext provides I/O load balancing using the DLC capability to balance demand across the SAN attached servers during file sharing operations to eliminate performance constraints. All I/O nodes can access the same file system simultaneously without queuing or unnecessary delays with more efficiency and resiliency over NFS. Thus, the organization can deploy I/O node resources according to production needs, thereby improving the efficiency of seismic processing operations.

“As a result of implementing the StorNext solution, all five seismic processing applications can concurrently share raw seismic data without unnecessary delay since all I/O nodes can access the same file system simultaneously without queuing,” said Feng Baomin, technical expert for EDRI of Daqing Oil Field. “Furthermore, it permits parallel processing operations through as many different I/O nodes as needed to meet the high performance demand. In sum, StorNext has greatly increased our overall seismic data processing efficiency.”

STORNEXT RAMPS UP PROCESSING POWER IN THE CLUSTER

Before the StorNext installation, there were 30, 1TB-sized file systems. This setup severely limited research as multiple I/O nodes could not access the same file system. To ensure a sufficient level of seismic operations, most of the I/O nodes were used to access these different file systems. However, this caused heavy system loads on I/O nodes and the cluster was not able to meet the requirements of large scale seismic data processing.

The StorNext file system operates in conjunction with the shared storage pool available in the SAN. This permits seismic operations to take place through many different clustered I/O nodes to meet the massive demands of shared file system space for seismic pre-stack time/depth migrating processing.

Further, StorNext Storage Manager performs seismic data archival, retrieval, data protection, and vaulting through the Scalar i2000 tape library. Based on parameters such as schedules, work areas, users and key processing criteria, GSC can migrate data from the online RAID systems to tape, thereby releasing disk space for other jobs. When any archived files are needed, they can be retrieved automatically from tape back to disk. Additionally, a clone of the final version of processed data can be replicated to the tape library to allow offsite vaulting and data protection for final data.

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Baomin Feng
Technical Expert

ABOUT THE DAQING OIL FIELD E&D RESEARCH INSTITUTE

Daqing Oil Field E&D Research Institute was founded in 1964. For over 40 years, the Institute has evolved into an oil research agency with comprehensive and strong technical disciplines and advanced equipment for petroleum exploration and development. The Research Institute places a strong emphasis on scientific research and production, and focuses on technical innovation so the sustainable development of Daqing Oil Field can be firmly based on the advancement of oil-related technologies.

Daqing has a staff of 1,800 petroleum engineering technicians, including two experts who have been recognized for their outstanding contributions at the State and Ministerial levels, nine senior experts of CNPC, 11 technical specialists and 41 academic and technical leaders.

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