

DRAMATICALLY IMPROVING TIME TO RESULTS FOR SEISMIC PROCESSING WITH DDN STORAGE AND LANDMARK SEISPACE

FASTER AND MORE ACCURATE EXPLORATION USING SHARED STORAGE WITH PARALLEL ACCESS

Using high performance parallel storage solutions, geologists and researchers can now incorporate larger data sets and execute more seismic and reservoir simulations faster than ever before, enabling higher fidelity geological analysis and significantly reduced exploration risk. With high costs of exploration, oil and gas companies are increasingly turning to high performance DDN storage solutions to eliminate I/O bottlenecks, minimize risk and costs, while delivering a larger number of higher fidelity simulations in same time as traditional storage architectures.

Halliburton Landmark ran a series of benchmarks based on common seismic processing workflows based on SeisSpace ProMAX. The purpose of these benchmarks was to independently validate hardware configurations in conjunction with seismic processing workflow and enable users to deploy best in class solutions for high productivity seismic processing.

DDN delivered 300% faster seismic performance than competing Network Attached Storage (NAS) approaches. Additionally DDN eliminated I/O bottlenecks enabling unprecedented 1100% improvement in large IO portions of the workflow. Customers using DDN solutions can run three times the number of seismic processing workflows in the same time it would take to run one workflow on competing traditional NAS ecosystems.

“*During recent SeisSpace Qualification Tests run at the Landmark R&D center in Denver, Colorado, DDN exceeded expectation in terms of overall performance, throughput, and scalability. Landmark and DDN recently created this joint Lab in Denver as the first step in a long term technical partnership to help customers get access to timely data to aid in geophysical HPC purchasing decisions worldwide.*”

Paul Heuermann
Global Business Manager - Seismic Processing & Depth Imaging

ACCELERATING SEISMIC PROCESSING WITH HIGH PERFORMANCE PARALLEL FILE SYSTEMS

MIMINIZING EXPLORATION RISK AND MAXIMIZING O&G PRODUCTIVITY

DDN parallel file system solutions offer several advantages over a network attached file storage systems and when used in conjunction with Landmark SeisSpace ProMAX, the advantages are:

- Efficient handling of large seismic data and ability to efficiently view a particular seismic dataset in different orders or domains without creating multiple copies.
- Fewer I/O bottlenecks in seismic workflows especially the large I/O portions of the workflow traditional NAS with serial access often falter. DDN is able to easily handle large I/O efficiently at scale.
- Higher seismic processing efficiency by delivering faster end-to-end workflow execution than traditional NAS environments. This is achieved by high throughput acceleration of data movement and enabling extreme performance for large and small I/O.

QUALIFICATION OF LANDMARK SEISSPACE ON DDN HIGH PERFORMANCE PARALLEL STORAGE SOLUTION

Landmark independently tested and qualified the production grade seismic workflows implemented using Landmark SeisSpace ProMAX software on a DDN GRIDScaler parallel file system appliance. The SeisSpace benchmark flow suite was run repeatedly on each of three hardware configurations available on site at Landmark's Highlands Ranch office.

DDN storage infrastructure comprised a performance oriented, mid-tier SFA7700 based GRIDScaler parallel file system appliance. Two other competing solutions that were also benchmarked were Network Attached Storage, based high end storage solution and a commonly occurring NAS setup often seen in many Oil and Gas companies.

Each test was run multiple times on each configuration in order to improve the accuracy of the results and the fastest observed wall clock time was retained for each setup. In addition to end to end wall clock times, highly granular sub-workflow times were also captured and analyzed for each run.

The benchmarks were designed to test and validate storage platforms using production

grade SeisSpace ProMAX workflows, enabling end-users to choose the best seismic processing infrastructure Landmark's validation testing comprised a subset of the benchmarking flow suite data to simulate a large modern marine seismic survey over a very simple geologic model. The data set simulated 'shooting' with 15 streamers, 500 channels per streamer and 6,001 floating point samples per channel (more than 3.2 million trances) over a geological model having layers dipping to the northeast.

Instead of storing and shipping this very large volume of data, only the shooting geometry and trace headers were stored, and one of the early flows automatically generated the large volume of synthetic data consistent with the much smaller stored shooting geometry. Other early flows subjected this data to several realistic read-write operations consistent with typical seismic data processing workflows. Additionally, several QC flows are included to ensure the integrity of the data, i.e. demonstrate that the simulations were not writing all zeroes, or leaving any gaps or errors of any kind in the output.

COMPUTE



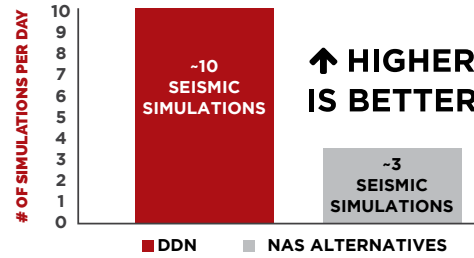
SeisSpace
ProMAX NODES

PERSISTENT STORAGE DISK TIER



DDN GRIDScaler®
SFA7700™ & SS8460™

DDN ENABLES 10 COMPLETE SIMULATION RUNS PER DAY VS JUST 3 RUNS WITH COMPETITIVE ALTERNATIVES



LANDMARK BENCHMARKS COMPRISING
PRODUCTION GRADE WORKFLOWS

CONCLUSIONS

More than 50% of the largest Oil and Gas companies have deployed DDN high performance parallel file system solutions to execute more seismic simulations and develop higher fidelity geological mapping. These independently validated benchmarks show why providing definitive quantification of DDN's unmatched performance for key data and scale intensive workflows in upstream Oil and Gas processing.

These results show how storage systems powered by parallel file systems can transform upstream Oil and Gas processing and enable unprecedented levels of oil and gas productivity and minimize exploration risks. Noteworthy attributes of the independently validated benchmarks include

- Most traditional upstream ecosystems (NAS and other parallel file system offerings) struggle with write intensive workflows due to "bursty" RAID interrupts. DDN SFA based solutions deliver unmatched and consistent performance for both read and write enabling as seen in the independently validated benchmarks.
- Traditional upstream ecosystems (NAS and other parallel file system offerings) are very poor at handling Large I/O portions of the Seismic processing workflow, often resulting in longer runtimes for seismic processing

workflows (as seen partly in the independently validated benchmarks). DDN aggregates performance and throughput across the system stack enabling more than 1100% faster runtime for large I/O intensive portions of SeisSpace workflow

- Even with the powerful and smaller form factor configuration used in the Landmark results, the DDN solution delivered 300% faster end-to-end runtime for production grade SeisSpace workflows. For mid-sized environments and independents, this translates to executing 10 seismic processing jobs using DDN SFA7700 in the time it would take to execute three same sized runs on traditional NAS infrastructure.

These independently validated results conclusively demonstrate why DDN is the preferred choice of data management solutions for Oil and Gas companies seeking to deliver hyper-productive upstream processing environments, minimized exploration risk and unmatched reduction in data center costs, while delivering higher performance and better, more timely results.

REAL WORLD RESULTS AND BENEFITS

The uncertainty in oil prices is driving energy companies to be extremely efficient to remain competitive in the market. Reducing end-to-end processing time is vital to success, especially under the current economic conditions. DDN's EXAScaler® and GRIDScaler® parallel file system appliances have received top honors and have won HPCwire's 'Best use of HPC in the Oil and Gas Industry' several times over the past few years. With high performance parallel data access solutions from DDN, Oil and Gas companies, have seen nearly 300% faster time to solution for seismic processing workflows, enabling them to deliver actionable results three times faster than traditional NAS environments. The primary advantages behind parallel storage are sustained high performance and the ability to easily scale upward to support larger workloads. When used in conjunction with data intensive seismic processing workflows, some examples of the advantages are:

- Scale storage I/O performance linearly or near-linearly with seismic processing workflows.
- Shared access to large volumes of data over multiple, internal teams
- Eliminate data silos and simplify data management infrastructure and minimize data center footprint and TCP
- More than 1100% faster execution for large IO portion of seismic processing workflows
- More than 300% faster end-to-end seismic processing workflow execution enabling three times more seismic simulations resulting in higher fidelity geological analysis

ACKNOWLEDGEMENTS

The storage equipment and parallel file system consulting support for the benchmark was from DDN; Landmark SeisSpace ProMAX support was directly provided by Halliburton Landmark.

ABOUT DDN®

DataDirect Networks (DDN) is the world's leading big data storage supplier to data-intensive, global organizations. For more than 15 years, DDN has designed, developed, deployed and optimized systems, software and solutions that enable enterprises, service providers, universities and government agencies to generate more value and to accelerate time to insight from their data and information, on premise and in the cloud. Organizations leverage the power of DDN technology and the deep technical expertise of its team to capture, store, process, analyze, collaborate and distribute data, information and content at largest scale in the most efficient, reliable and cost effective manner. DDN customers include many of the world's leading financial services firms and banks, healthcare and life science organizations, manufacturing and energy companies, government and research facilities, and web and cloud service providers. For more information, visit our website www.ddn.com or call 1-800-837-2298.