

High-Performance Data Storage Turbocharges Seismic Processing

Introduction

Exploration and production (E&P) companies and their service partners relentlessly seek leading-edge information technology (IT) solutions for seismic processing. No wonder: IT environments that process seismic data faster and compute larger earth models offer shorter time-to-revenue and can improve interpretation, reduce drilling risks and enhance hydrocarbon recovery. As one observer says, "It's almost like printing money." Some organizations deem these competitive advantages so compelling, IT advances applied to seismic processing are kept under wraps.

However, word is leaking out about data storage solutions that speed seismic processing and increase the size of computational problems so asset teams can improve their understanding of the subsurface. These solutions can also reduce IT costs and system complexity.

To achieve such results, companies are quietly deploying storage area networks (SANs) populated with high-performance, terabyte-scale storage systems that outperform nearly all other types of commercially available systems. Organizations report that combining SAN technology with these powerful storage systems deliver more "bang for the buck" than either component alone.

Further, these savvy organizations increasingly specify data storage solutions from LSI Logic Storage Systems, Inc., as the highest-performing solutions and the best overall storage value.

Delivering Larger Jobs On Deadline

Kelman Seismic Processing, a global service provider, has earned an industry-wide reputation for its high quality pre-stack time and depth migrations. These migrations let E&P companies more accurately pinpoint hydrocarbon targets, particularly in complex geologic settings where seismic signals can be misleading — for instance causing “ghost” images that, like subsurface mirages, look like the real thing.

Like all seismic processors, Kelman faces the challenge of processing large pre-stack data sets on deadlines driven by economics and customers’ business requirements.

“Used to be that we had to pull data from tape, process it and write it back to tape, an extremely time-consuming process,” recalls Reed Haythorne, president of Kelman. “We required six months to migrate a typical two-terabyte data set. In some cases that meant declining large projects.”

That’s changed. Kelman revamped its storage infrastructure, adding a SAN and more than a dozen terabytes of high-performance MetaStor® systems from LSI Logic Storage Systems. As a result, Kelman now migrates seismic data sets exceeding two terabytes with four-month turnaround, cutting two months from its previous cycle time.

“We just completed a large migration for a major oil company,” says Haythorne. “They needed it to interpret prospective targets before a U.S. federal lease sale on some promising Gulf of Mexico blocks. Without our SAN and high-performance storage systems, there’s simply no way we could have made that deadline. We would have had to turn down the work.”

Pre-stack migrations are among the most compute-intensive and data-intensive calculations performed in any type of business. Pre-stack processing makes use of an entire seismic data set rather than a stacked, or averaged, subset — thereby capturing nuances that can yield superior understandings of earth models. Migrations correct for false or misleading seismic signals, reducing drilling risks and enabling E&P companies to make better competitive business decisions.

Benefits of the SAN and high-performance LSI Logic storage solutions go beyond application performance, Haythorne says. “Not all migration cycle time is devoted to computation.

“For instance, once the data has been binned, we access it to look at velocities, and at the gathers, to determine how velocities and statics and other variables are affecting the data,” Haythorne says. “We work with these gathers all the time, reading the full data set from storage, crunching the numbers and reading them back to another disk. When we do this with high performance RAID over the Fibre Channel SAN, the speed is amazing. Compared with our previous storage solution, it’s like night and day.”

A minor portion of Kelman’s overall cycle time improvement stems from a moderate increase in processing power, notes Haythorne. But he attributes the lion’s share of improvement to the new storage solution.

“There’s no question,” he says. “This storage solution generates business for us and makes us more competitive. It paid itself back in the first six months. We are extremely pleased.”

Achieving 400 Percent Faster Processing

Another organization performs seismic processing on an even larger scale. A manager there says, “We typically process data sets in the three- to seven-terabyte range, and some larger. Before, we had

individual servers each configured with many terabytes of disk. These were large, state-of-the-art servers that gave us a cycle-time advantage over most seismic processors.

“Loading a large data set using an automated tape library and a high-speed conventional network took about 10 to 14 days; processing another 30 days,” the manager says. “With additional servers plus a SAN and high performance RAID, processing cycle time plunged. Data sets that took a month to process, now take a week, using the same algorithms as before. Loading and processing are both accelerated.”

In many cases, he adds, asset teams are using reduced cycle time to gain a better understanding of the subsurface by running multiple iterations within deadline. “As always, velocities and parameter choices are optimized with interpreters’ input. But when processing took a month, teams had to be relatively conservative in their approach. Often they couldn’t afford the time to have us run multiple iterations, each requiring several weeks to process.

“Now our customers have far fewer constraints. They explore ideas, try various algorithms to see which approach delivers greatest insight into the subsurface. We have many reports of specific field successes that teams attribute to this newfound freedom to test earth models.”

To achieve dramatic cycle time reductions, server clusters demand huge data quantities delivered at high speed. The organization accomplishes this by populating a Fibre Channel-based SAN with high-performance storage solutions from LSI Logic Storage Systems.

“We had several years prior experience with LSI Logic storage solutions,” says the manager, “and we continue to benchmark it against other vendors. It consistently delivers the best raw performance, application performance and overall value in terms of cost-performance.”

“Further, availability and reliability have proven to be extremely high. I can’t recall a single instance of data loss resulting from these storage systems. That’s crucial because processed data, combined with intellectual capital, is our meal ticket.”

He notes that vendor support is also an important factor in the value equation. “The vendor also provides great on-site support. They really partner with us, showing pride of ownership in our smooth operation.”

Conclusion

Another seismic processing organization, GeoCenter, similarly reports a 400 percent to 500 percent application performance boost with the use of high-performance storage solutions from LSI Logic. “Before, we were using tape and slower disk,” says company president Sukhdev Hyare. “We’ve been relying on the new solution for quite a long time, with excellent results.”

Reports from these and other seismic processing organizations reveal that SANs and the highest-performing storage systems together are driving dramatic improvements in seismic processing application performance, quality and economics.

Ultimate business results include shorter time-to-revenue, reduced drilling risk and superior recovery plans stemming from more refined understandings of the subsurface.

As the size of seismic data sets continues to rise, and as multidisciplinary asset teams work more interactively with seismic processing organizations, the need for these performance increases will become even more crucial to E&P success.

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