Sea of data

Robert Roe explores the use of HPC storage technology in offshore energy exploration

Energy companies are under tremendous pressure to safely and cost-effectively extract oil and gas from undersea reservoirs. To better understand where and when they should drill, these firms rely on seismic surveys to provide complex decision-support information.

Michael Tortorello, account executive at Panasas for Magseis-Fairfield, states: 'These use cases, in particular at Magseis-Fairfield and others that we do business with, is an endpoint computing environment. These vessels at sea are essentially data acquisition environments. They are deploying echo-sounding devices for long periods of time, collecting data and then transferring it to storage on ship.'

This process creates huge quantities of data that need to be pre-processed, then transferred to a datacentre for analysis, creating HPC workflow that must be rugged and reliable, while delivering high performance.

'The customer wants high-performance storage, but that is not their primary concern. Their primary concern in these use cases is ease of use and reliability. A firm comes to Panasas specifically for our appliance. Panasas has built a purpose-built system, hardware and software that is easily maintained and easily managed,' added Tortorello.

Magseis Fairfield is a geophysics firm that specialises in providing seismic 3D and 4D data acquisition services to exploration and production (E&P) companies. Using advanced ocean-bottom node (OBN) technology, the services enable the high-resolution imaging of geologic structures and reservoir data. With this data, energy companies can evaluate future opportunities and improve current reservoir development, maximising the value of their multimillion-dollar E&P projects

The company's Marine Autonomous Seismic System (Mass) and a range of Z technology – combined with automated handling, deployment and retrieval systems – allow Magseis Fairfield to offer clients safe, efficient acquisition of high-quality 4D data.

Magseis Fairfield has extensive experience in seismic acquisition, from traditional ocean-bottom cable systems to their Z node design. The company has designed a system that encapsulates the recording system, battery and sensors into one unit, removing the requirement of cable systems.

The company have more than 30 deepwater acquisition projects in the Gulf of Mexico alone. Branching out in 2009 to the Red Sea, North Sea, West Africa, Caribbean and South America, they have expanded their node system technology to the transition zone, shallow water, and permanent monitoring systems. These designs have been used across the globe by various companies, each recognising the benefits of this technology.

The traditional seismic acquisition relies on at least two seismic vessels: a shooting vessel and a recording vessel or node vessel. The shooting vessel releases high-energy sound waves into the water column, radiating down through the subsurface layers. Akin to radar, the reflection of these sound waves are used to create an image of the subsurface.

The recording vessel, in this case, a node vessel, deploys node units to the seafloor to record the feedback reflections of those sound waves from the subsurface layers. With the combination of the two vessels, the recorded seismic data provides an image of the subsurface geologic formations, and characterises the subtle changes in active recovery reservoirs. Because node systems can be deployed in almost any survey design and record data for up to 160 days, ultra-long offset, full azimuth surveys are easily in reach.

Node units are less than a metre in diameter and, by removing the dragging of heavy optical cables on the ocean floor, they have decreased the risk of damage to existing systems. Yet increasing regulatory, shareholder and environmental demands on energy companies are intensifying the challenges of data collection and storage.

Clients need detailed, high-quality information to create more accurate reservoir models, which helps to reduce the risk of drilling errors, avoid unnecessary disruption of natural sites, and streamline resource extraction. 'Marine surveys are changing, covering wider geographic areas and acquiring much larger data volumes offshore,' says Janie Garcia, manager of onboard processing at Magseis Fairfield. 'Our data storage for

offshore projects has grown from 250TB per vessel to as much as 600TB. This data is critical for our clients, so we cannot afford failure of any type when it comes to storage.'

Rugged technology

Magseis Fairfield initially chose Panasas ActiveStor nearly 10 years ago to meet its shipboard data storage requirements for marine surveys. The firm now runs several generations of Panasas storage technology throughout the enterprise. Together, these Panasas solutions provide 1,600TB of storage that supports a wide range of client projects.

'Our storage solution must be robust enough to survive the offshore environment,' said Garcia, who is responsible for overseeing, managing, organising and facilitating the data for shipboard scientists, while ensuring data quality for clients. 'This system is accessed 24 hours a day. We require flexibility to move equipment from one vessel to another, and one country to another. The storage system must be able to tolerate this type of constant handling. We have considered other solutions, but none offer the full complement of technology and remote support Panasas does.'

The geoscientists who use ActiveStor receive hardware and software training, but they are not technology experts. There is no dedicated IT department on the vessels. For these reasons, Magseis Fairfield requires a storage solution with fast, simple operations and remote support. Survey teams also need a solution with an intuitive, graphical management interface, so non-technical personnel can perform maintenance.

Panasas has intentionally designed its systems to be as user-friendly as possible. In traditional HPOC environments, this helps to save on costs and maintenance, but in emerging markets or endpoint computing environments this can be the difference between a successful project or failure.

Dale Brantly, director of systems engineering for Panasas, reflected on the design principles that drive the development of new products. 'It goes back to the beginning of the product design. When Panasas launched in 1999, the idea was to build an easy to use, easy to maintain appliance, so the product originated with that concept.

'It is different than having a parallel file system and then trying to make it easy to use – that is backwards from the design process. You need to have that thought that it is designed in such a way that it has as few replaceable parts as possible,' Brantly added. Panasas technology enables users to deploy and scale in hours, and user training requirements are limited.

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'Thanks to the Panasas architectural design, it's easy to move components, scale storage, test systems and keep things running effectively,' says Garcia. 'Our teams can perform maintenance and deploy new systems quickly. The modularity makes the solution flexible enough to make any changes needed to support each client project.'

Reliable, consistent, and predictable performance

'We want to make things easy to use, so you do not have to be a rocket scientist in a lab coat to use it. We provide an informative user interface, we have a support infrastructure that helps to support that through, so people can understand error codes,' said Brantly. 'While I don't think it is fair to say that anyone can do this – it does require some IT skills – but it doesn't require a computer science graduate to get high performance from this system. The system is designed to deliver high performance out of the box.'

A single offshore acquisition consists of 80 to 100 personnel, including navigators, geophysicists, marine mammal observers, and remotely operated vehicle pilots. Considering staffing a vessel with a full crew can cost firms more than $200,000 a day, an extended outage could cause a loss of hundreds of thousands, or even millions of dollars. A highly reliable storage solution reduces the risk of downtime.

'Even when we bring on additional data, Panasas still performs exactly as we would expect,' says Garcia. 'We can count on the solution to handle everything we can throw at it. That helps us meet our deadlines and ensure that clients get the information they need.'

Panasas' 24-hour-a-day remote support ensures that an expert is always available to geoscientists who need help troubleshooting storage issues. Equipment can be replaced when needed, but downtime is rare. 'If our storage solution cannot meet client needs, our projects will miss the mark,' says Garcia. 'Part of the reason we've relied on Panasas for so long is that the solution and support they provide give us peace of mind.'

While uptime is important to many HPC applications, the importance in this type of workflow is critical to the success of businesses like Magseis Fairfield. Without the ability to keep these systems working as intended, in harsh unforgiving environments for computing equipment, their business would not be successful.

Removing the complexity and making HPC as accessible as possible for users allows enterprises and academic or government institutions to reduce costs, which helps scientists and researchers focus on primary goals. Domain specialists or geophysicists should not have to worry about their computing infrastructure. This diminishes productivity and wastes valuable resources.

Tortorello said: 'We see this more often in the smaller environments than the larger environments, such as a departmental lab or a genomics lab that is six guys doing their science. They don't want to spend money to hire an IT guy, they want to do it themselves as a sideline. They do not want to spend more time with IT resources than they need to.

'We aim to make HPC accessible to non-IT experts, such as endpoint computing environments,' added Tortorello. ■