Running Hot and Hard: DownUnder GeoSolutions Powers up for Oil & Gas Opportunities

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Oil and Gas industry service provider, DownUnder GeoSolutions operates one of the largest high performance computing installations in Australia. Like other organisations, it faces significant power and cooling challenges whilst striving to improve the cost efficiency and performance of its IT infrastructure to gain competitive advantage. This IDC case study outlines the business and technology context in which DownUnder GeoSolutions operates and it examines its decision to deploy a high density rack of AMD's new Opteron 6200 chips as part of its 15,000 core HPC installation.

Mining the Compute Opportunity

Australia is well known for the success of its resources industry and the role it has played in ensuring the nation has a strong economy. To cut a long- and highly-successful story short, the resources boom has been bountiful for Australia, including the Oil and Gas industry, and even more so for the state of Western Australia (WA). The Western Australian Department of Mines and Petroleum claims the resources industry delivered a record $101 billion in sales in 2010-11 in the state, with China the biggest customer of exports taking 42% of commodities shipped overseas. The petroleum sector is the second largest in WA after iron ore providing $23.2 billion of sales in 2010-11. Liquid Natural Gas (LNG) was the second most valuable commodity in the state with an output increase of eight percent in 2010-11 and sales of $8.7 billion. This growth is expected to continue with several multi-billion dollar projects now underway.

Indeed, when looking at the federal Department of Agriculture, Fisheries and Forestry (ABARES) bi-annual report into new projects in the minerals and energy sector in May 2011, it was found that at the end of April 2011 there were 94 new projects at an advanced stage of development across Australia with a record capital expenditure of $173.5 billion; an increase of 31% from six months earlier. Petroleum makes up 61% of the value of these projects with WA taking 63% of the geographic share. Figure 1 below highlights the extent of new mining and energy activity in the Australian market.

Solution Snapshot

Organisation: DownUnder GeoSolutions

Operational Challenge: Achieving optimal cost-efficient performance with its HPC installation to stay ahead of competitors in a booming oil and gas industry and increase profitability

Solution: One 42RU rack of SGI rackable servers in Perth, loaded with AMD's new Opteron 6200 chips, which equates to up to 2688 cores in one rack

Project Duration: On-going

Benefit: 20-30% performance improvement in code performance, 10% lower energy use, 25% lower TCO. Higher density computing with reduced floor space requirements

A Map of Advanced Minerals and Energy Projects under Development in Australia as of April 2011
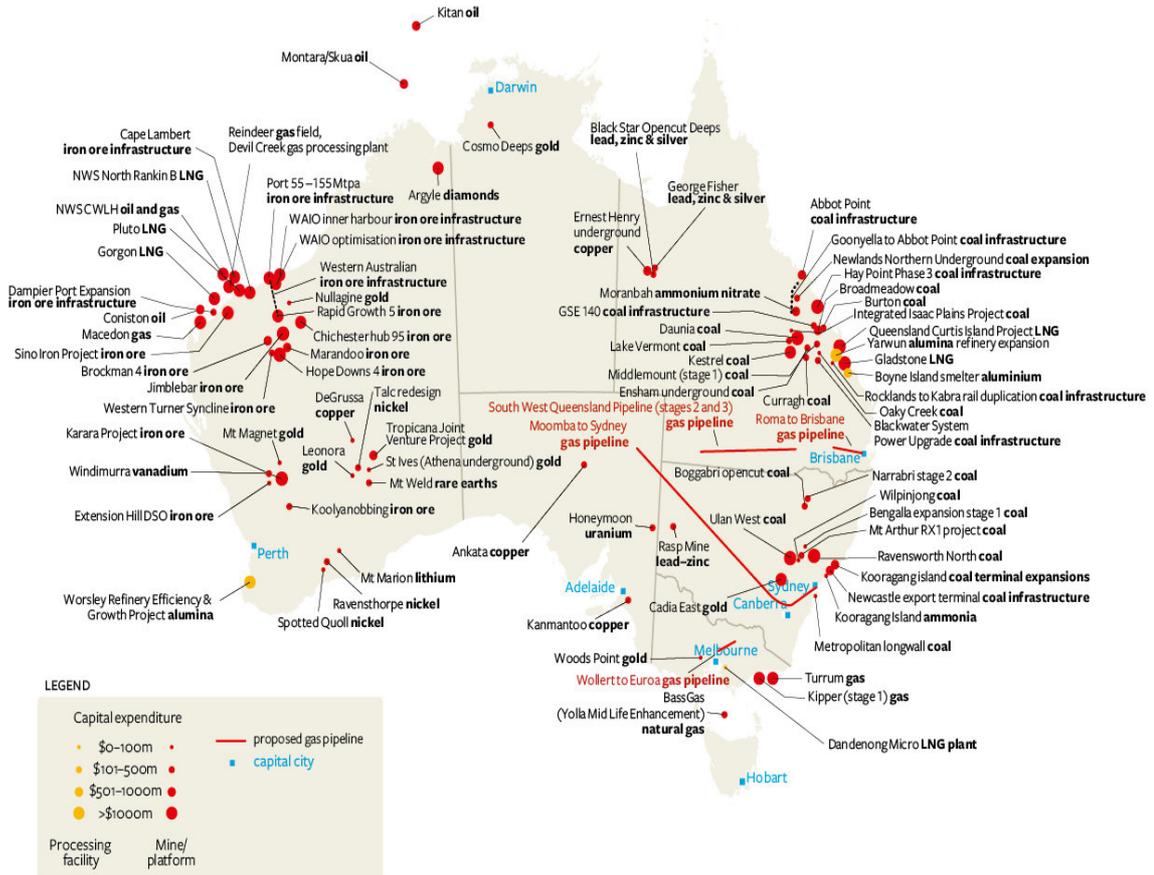
Source: ABARES, April 2011

What is less well-known about the Australian mining boom is the extent to which ICT has helped bolster this success, particularly the use of high performance computing (HPC) in helping to process the data used to make capital expenditure investment decisions like those indicated in Figure 1. The level of exploration expenditure in Australia has grown four-fold since 2000. As a result, and considering the maturity and fiercely competitive nature of the industry, using more powerful HPC facilities that can more quickly deliver actionable insights from captured exploration data and thereby reduce non-productive time has been essential to the success of the industry. It is here that companies like DownUnder GeoSolutions, and the kind of IT infrastructure it uses to provide HPC services to oil and gas clients, play a critical role.

Out Compute, Out Compete

DownUnder GeoSolutions is a Perth-based service provider to the Oil and Gas industry formed in 2003. It has 120 people working across Perth, Brisbane, Melbourne, Kuala Lumpur, Jakarta, Singapore and Toronto with additional plans for further expansion. Its offerings include a software suite for data interpretation and analysis; along with a range of professional services that include petrophysics, seismic data processing, depth imaging, geostatistical depth conversion, quantitative interpretation and pore pressure prediction. It operates a 15,000 core HPC installation; possibly the largest in the country and a strong growth area for the company due to the extensive exploration taking place in the industry.

This large core count, which has been growing on average by an additional 1000 cores per month (they bought seven high density racks of IT equipment in 2011) is fundamental to DownUnder GeoSolutions' business; they want to put as much data through the servers as quickly as they can in order to provide the most efficient service for their clients. These clients often have, for example, oil and gas exploration vessels traversing the ocean capturing large sets of data that will be analysed using DownUnder GeoSolutions services, and used to make investment decisions on what will be multi-billion dollar projects like some of those shown in Figure 1. A simple explanation of how this data is captured is that these vessels have arrays of airguns that set off signals under water and as the sound travels down into the earth's crust it then is reflected back up through the water to be captured by dozens of hydrophones (pressure sensors) contained in cables trailing the ship. A typical configuration for acquiring this data would be one vessel with two gun arrays, ten cables hanging behind the vessel at 12kms in length each, with the cables are 150 metres apart and a pressure sensor situated every 12.5 meters along each cable. These pressure sensors capture the raw data - which is stored on tape, often up to 30TB of data, which is then shipped to DownUnder GeoSolutions.

A survey such as this may last 1 to 6 months with the time taken to acquire this data usually around 60 days at up to a million (Australian) dollars a day - clearly time is of the essence. DownUnder GeoSolutions processes the data through its HPC installation and software tools and provides up to three versions of the output data on tape (up to 100TB, or 300 tapes after processing) back to the client; one for the client, one for joint venture partners, and one for the Australian government as copies of all exploration data must be provided to the authorities according to domestic regulations (although there is a period where the data is exclusive to the company that captured it). When the data becomes publicly available, any exploration company is able to buy the data from the government and then ask someone like DownUnder GeoSolutions to process it; it is not uncommon for the same data to be processed several times, for several different clients, over a number of years. As a result of both types of projects - newly acquired exploration surveys and reprocessing of existing data - DownUnder GeoSolutions, and its competitors, are benefitting first-hand from the Australian resources boom. But reaping these rewards is not without its challenges.

DownUnder GeoSolutions' Challenges

DownUnder GeoSolutions competes directly with massive multi-national companies in the global oil and gas industry. Some of these large corporations have huge installations (some many times larger than DownUnder GeoSolutions) and also have IT infrastructure located on the exploration vessels for onboard processing. Consequently the company lives and dies by the performance and cost efficiency of its IT environment - the faster it can process data at a more cost-effective rate the more successful it will be as it will be able to provide time-poor customers with a highly competitive service.

In fact DownUnder GeoSolutions is driven by total cost of ownership (TCO) with the purchase price of its IT infrastructure, typically equating to one third the cost of operations. It runs its own multi-threaded servers in its own datacentre, hot and hard, 24 hours a day - there is no 'idle state' with its infrastructure and no cloud (public or private). One rack of IT equipment in its datacentre on average draws 35KW with the power bill reaching into the hundreds of thousands of dollars

per year. IDC research has shown that power and cooling is one of the top challenges for Australian organisations that operate their own datacentre facilities and DownUnder GeoSolutions is no different in this regard.

Fortunately due to being located between three big hospitals in Perth, the company has a steady supply of power. All of the servers are liquid cooled with chillers located on the datacentre facility roof. While cooling is an ongoing challenge, as it is for many organisations that run their own datacentre facilities, it is the energy consumption of its servers that has provided a key challenge and an opportunity for the company. The lower the power *and* the higher the density of these servers equates to more cost-efficient performance, and this is king for DownUnder GeoSolutions as it is for its competitors. As DownUnder GeoSolutions operates in a highly competitive oil and gas ICT service industry, it strives to retain its competitive edge by adopting the latest server technologies and passing on the performance benefits to its clients ahead of its competitors.

The Solution

DownUnder GeoSolutions has deployed a 42RU rack of SGI Rackable servers in Perth, loaded with AMD's new Opteron 6200 chips. All hardware and software integration was completed in SGI's factory prior to shipping to DownUnder GeoSolutions. SGI positions the servers as being highly flexible to match workloads and offering leading system RAS and management capabilities. Meanwhile, the 16-core AMD Opteron 6200 server processor, previously referred to under the code-name Interlagos, was announced on November 14, 2011. The 32nm Opteron 6200 offers clock speeds of between 2.1GHz and 3.6GHz. AMD has also stated a performance improvement of up to 84% over previous generations of the Opteron processers running the vendor's "Bulldozer' architecture, and a power-per-core reduction of 50%. The Opteron chips are also being positioned by the vendor as delivering improved performance, scalability and efficiency for targeted workloads that are highly threaded, like HPC, database and virtualisation, plus new workloads that are emerging from increased growth in the web and cloud markets. In order to achieve these improvements the chips come with additional features, including:

- AMD Turbo Core Technology - The Turbo Core technology provides increased performance when needed while maximizing power efficiency. The Opteron 6200 utilises thermal design point (TDP) to categorize the processors. If there is available TDP space within each of the workloads, the Turbo Core is activated to allow the clock speeds to increase by 300 to 500MHz across all of the cores.

- TDP Power Cap - AMD's TDP Power Cap technology provides the capability to set power restrictions to improve the energy efficiency in the datacentre without limiting frequency levels. Creating a feature for monitoring and controlling the level of power usage results in the ability to utilise previously unavailable space in a rack and increase the server density.

Benefits

DownUnder GeoSolutions was attracted to the Opteron 6200 chips because it could have 16 cores in one chip, four chips in one motherboard, considerably more memory and all of that in a 1RU form factor. The new server technology has allowed them to reduce their floor space and achieve greater density: up to 2688 cores in the same space as used to be taken by 1008 cores. Further, the sort of calculations the company executes are CPU intensive but while the calculations scale linearly with the cores, they don't scale linearly with the memory. The more memory they have the more efficient their algorithms become and this is one reason they invested in the new AMD chips, so that they can run large amounts of memory in a single system image with a large thread count. This has made their code 20-30% more efficient. Whilst the performance has improved, importantly the energy use of these servers is also 10% lower and the TCO of this infrastructure over a three-year period expected to be 25% less.

Conclusion

In the Asia Pacific region IT spending in the Oil and Gas industry is expected to rise from US$11.36 billion in 2010 to over US$15.54 billion in 2015, just out performed by North America which will hit US$17.5 billion. Like many of its peers, it is an industry with many organisations that will continue to require leading edge technology services and products to gain competitive advantage, especially in the HPC field as more and more data is captured and generated. Australia will play a leading role in this industry for some time to come and IDC expects many more organisations like those described in this case study paper to pursue the same goal of improved cost-efficient performance with the IT infrastructure within their datacentres. The DownUnder GeoSolutions example is one that proves that server and infrastructure performance remains vitally important to business success. But with the latest chip technologies hitting the market, it does not need to come at the expense of power, space and cost efficiencies.

Methodology

The project and company information contained within this document is the result of both primary and secondary research. Information was supplied by various sources, including AMD, questions posed by IDC directly to DownUnder GeoSolutions employees, and DownUnder GeoSolutions corporate documents. The research conducted by IDC included a verification and validation process to confirm all claims made by the sponsoring vendor and its customer.