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Pushing Interpretation Boundaries

Oil and gas companies purchase and gather an enormous amount of exploration data, including seismic. But only a portion of that data is effectively utilized. Paradigm, an industry leader in digital subsurface asset management, aims to change that.

Some of the squandering of rich reservoir data is due to technological limitations. New interpretation tools promise greater utilization and clarity of analysis, but demand ever higher computer processing power.

Step forward the GPU (graphics processing unit). GPU usage in seismic processing is coming to the fore, and from February will be commercially available in one version of Paradigm's Reverse Time Migration (RTM) software. RTM was developed in collaboration with Acceleware Corp., a leading developer of high performance computing applications.

Philip Neri, Vice President of Marketing at Paradigm, says GPU usage in seismic processing in the past year or so has become "the talk of the town as a way of dramatically increasing the execution of computer intensive applications at a relatively lower cost compared to increasing

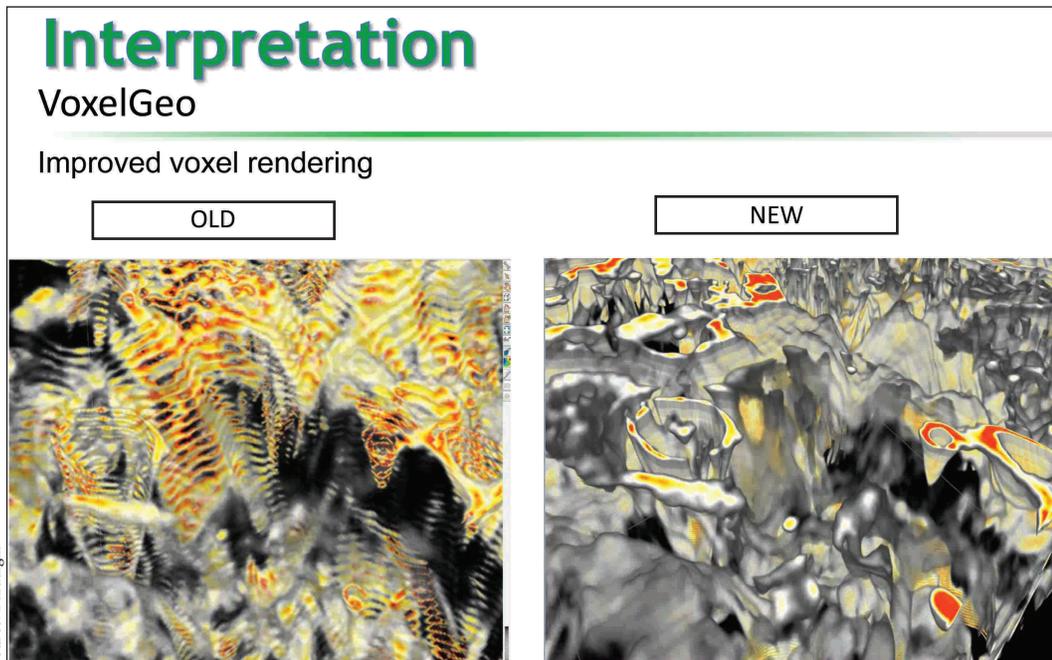
CPUs." GPUs are also more effective at dissipating the heat generated in massive data crunching, for which there is an associated cost savings in the management of large data processing centers.

Rewritten Rendering

Many software products evolve year after year underpinned by steadily aging architecture, which over time constrains their performance and potential. With this in mind, Paradigm has completely rewritten the rendering engine of VoxelGeo, the market leader in 3D volume interpretation tools. "Like all the other players in this field, for the last 15 years we have been relying on technologies that were relevant in the 1990s in how to render objects in 3D space with transparency," says Neri. "We have developed and leveraged completely new approaches to this, and the result is pictures that have practically no

aliasing, no visual defects, no matter what angle you look at it from. The pictures are much smoother and have more body and flesh to them."

An added benefit of the VoxelGeo rendering rewrite is performance gains – to the tune of factor-40 acceleration in the number of VoxelGeo we can display per second, says Neri. "While people are not doing volume interpretation every day, acceleration of that nature is indispensable to help people work with large data sets and on what we expect to be larger display screens as they have to integrate more and more data." Such speed gains might enable quicker turnaround of interpretation. "We tend to



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caution clients against compressing the turnaround cycles,” says Neri. “It’s more about being able to explore multiple scenarios within a given time frame.” So, instead of settling for one interpretation, people can explore various possibilities and then have tools that allow them to select the one with the least uncertainty. “We are providing increased productivity not to crush your interpreters to do more work in less time but to have more time to do a proper risk assessment and evaluation that makes you more confident in spending the high stakes money in drilling.”

Paradigm is looking to boost efficiencies elsewhere too. “Data infrastructure is incredibly important,” says Neri. “Most people are spending anything from 20% upwards of their time just looking for the data and bringing it into the system to work on. We are aggressively challenging these accepted numbers and trying to bring it down into the realm of 5%. That is done with intensive investment in a data infrastructure that is tailor made for oil and gas exploration and not just a reuse of some generic data management solution.”

Redefining Interpretation?

In October 2010 Paradigm hosted the Redefining Interpretation Industry Briefing at the Society of Exploration Geophysicists International Exhibition and 80th Annual Meeting in Denver, Colorado. “What we are trying to say with redefining interpretation is that we see interpretation as a pervasive activity; it is not just happening within the few professionals in an asset team,” says Neri. “The message here is that interpretation is no longer the remit of just a few geophysicists come geologists. It is not just one step of the overall workflow, but really the whole team is constantly interpreting right through to the last target well proposal.” And Paradigm provides an architecture that allows everyone to use everyone else’s interpretation, to lead to a conclusive document that really analyzes all aspects of the data, the risks and uncertainties, in order to make the best decision.

Seismic interpretation is frequently regarded as an established technology with little more to offer. “We are struggling against a frequent perception in the industry that seismic interpretation is *déjà vu* – it’s like word processing – that there’s nothing new to invent in this field; we strongly disagree. There is a lot of potential, the Paradigm 2011 release is showing a lot of that potential out there, and our research is going further into the future in this field.”

The Paradigm 2011 application suite sees a number of new capabilities. “The most salient aspect of this new release is the integration of prestack data into poststack traditional work flows, not just interpretation but also characterization and attributes, inversion and other techniques,” says Neri. “We have always had access to prestack data in a specific window, but what we have done here – and taken to a whole new level – is having prestack data in the 3D viewer; prestack data linked to the actual interpretation processes, with tools around it that allow you to look at the illumination in 3D at any subsurface point.”

A further area of new capability is capitalizing on azimuth rich data. “Companies have been spending an extra \$100 million each on Azimuth rich data, and until we came along if you looked at the interpretation tools there was no way to accommodate the information they were

generating,” says Neri. “It was just a subsidiary piece of information. For companies that have invested heavily in Azimuth rich data, we are bringing a full suite in terms of interpretation to the table.” As a full suite, Paradigm 2011 provides a seamless infrastructure spanning both imaging and interpretation. “Other systems on the market are leveraging different information technology frameworks as they go from the imaging environment to the interpretation.”

Another area Paradigm has targeted for advances is in data reduction. “We are working aggressively on data reduction technologies,” says Neri. “With the advent of prestack data in mainstream interpretation workflow – which we are adamant will be happening over the next

Paradigm in Africa

Paradigm is a software development and selling organization. “The services we offer around our software are strictly about helping our customers architect their systems and giving them training advice on workflows,” says Neri. “A lot of our tools of course play well to offshore data, and stratigraphic type of plays, turbidites, and channel systems that Nigeria and Angola have in abundance.”

Neri says Paradigm software is playing well in Africa with major customers using it as part of their efforts to do more regional studies, such as a number of blocks offshore Nigeria, crossing international borders and spanning neighboring countries. “They are stepping back to do mega regional interpretations, and this can involve more than a terabyte of poststack seismic data and thousands and thousands of wells, and information pertaining to this and various vintages of interpretation over many years. They want to allocate to a team the task of looking at the big picture, looking for major trends in all the different productive formations, and trying to understand the structural and sedimentological picture instead of focusing on particular blocks. Our EPOS high performance data infrastructure is well suited to this type of activity.”

few years – you are multiplying by a factor of 50 the amount of data on the interpreter’s desktop in order to perform a comprehensive interpretation.” That is beyond even the heady data storage advances witnessed in recent years “unless you come up with intelligent decimation,” says Neri. “We are working on technologies to intelligently decimate or compress prestack data so there is minimal information loss but we can drive the volumes down by an order of magnitude manageable in the current storage systems.”

Driving Efficiency

Software in the exploration business is sometimes given short shrift. The kind of investment made in software technology pales in comparison to the expense made in drilling and data acquisition. Neri says in the exploration division 80% of the money spent is on drilling, with up to 17% spent on acquiring the data. That leaves just 3% for software technology and people.

“Companies who are similar in their activity footprint take a very different view in how to drive efficiencies once you have committed to the expenditure on the drilling and the data.” Neri draws an analogy with digital photography. Enthusiasts can spend tens of thousands of dollars on cameras and lenses, but they wouldn’t dream of using the freeware that comes with the camera. They will opt for a professional software product such as Photoshop.

“We are a global company with 650 companies as our customers, including all the majors. Some of them are constantly driving

investigation into what is the best set of solutions, whether workflows or software tools that will squeeze the most out of every piece of information they have got. Others say we have a five-year contract with a software company, it’s pretty much working with few complaints so it’s not even a topic for discussion within the company.”

Rather than just drill-it, drill-it, Neri stresses that there is a lot of technology available now that allows you to have a more analytical approach to where you drill and how you fracture formations. “There is information within the data that these companies purchase. Some say yes of course, enlighten us; help us to be more successful. Others say the important thing here is to get drilling.”

It follows that more expensive drilling prospects garner more attention. “Certainly deep offshore where wells cost anything from \$50 million-\$200 million dollars, you will find operators are more sensitive to technology than people who are drilling onshore where it is only a couple of million dollars a well.” 

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