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Advanced Visualization Systems Quicker, Can Handle Larger Data Sets

By Elsie Ross

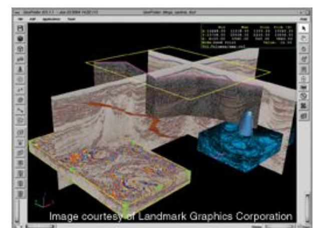
WITH A $1 MILLION-PLUS PRICE TAG, UP UNTIL now advanced visualization systems have been a luxury that small or even intermediate oil and gas companies can only dream about. With the introduction of Silicon Graphics Inc.'s new patented Prism system starting at $30,000 (US), the rapid analysis of huge sets of data has just become more affordable.

SGI's Prism is the first advanced visualization system for Linux.

"This is a real revolution," says Bill Bartling, senior director of market strategy, energy, for the Mountain View, California-based high performance computing, storage and visualization company.

In its Prism product, SGI has replaced its proprietary MIPS chip with Intel Itanium 64-bit architecture processors and its IRIX operating system with the Linux open source operating system. "The net result has been to put an extraordinarily high performance CPU (central processing unit) in the system," he says.

SGI has been able to leverage Intel's research and development, which reduces its costs, while open source Linux is not only less expensive but offers its customers flexibility to use different kinds of systems, says Bartling.



BENCHMARK TEST - Image showing 400 gigabytes of seismic data rendered in GeoProbe 64-bit software on SGI scalable visualization technology.

The system has been outfitted with ATI graphics cards, all within SGI's proprietary motherboard design. The new product is unique in that memory, processors and graphics cards are all scaleable, independent of each other, he says. "If you need more memory, you buy more memory."

In the past, geologists or geophysicists working with large amounts of data have always had to partition it and then try to piece the edges back together again. "It is always the boundary faults that get you," says the former oil company geologist. "Being able to look at the entire model interactively is a huge breakthrough."

The team at the Calgary Centre for Innovative Technology at the University of Calgary, which has a Prism visualization system on order, is excited about the possibilities, says Paul Masiar, HPC Technology consultant. "The Prism system is so much faster than the current SGI system that we have we will be able to process data sets in-house which are 10 to 100 times greater."

The CCIT selected the Prism system because its "ultra-fast" Intel 64 architecture, scalability and graphics visualization performance set it apart from other systems, according to Masiar. In an earlier demonstration, the system's visualization capability and the concept of a single system image where very large data sets could be stored in memory was something that was very appealing to the oil and gas industry, he says.

The new system, which also includes a software donation from Landmark Graphics Corporation, will be used by medical and scientific researchers as well as by oil companies for visualization and seismic data processing. While Prism will be available to commercial clients at a "fairly low cost," companies are advised to book time, as with complex applications it is a good idea to have a support person available, says Masiar.

Beginning with a small amount of data, an interpreter using the Prism system can quickly turn that into a large amount of information, all highly relevant to the decision process, says Bartling. For example, in a test dimensional survey data. SGI then took that amplitude data and "on the fly" created a new continuity volume product, emphasizing the edges of the stratigraphic body that can trap oil. If the operator had not been using Landmark Graphics' GeoProbe product in the Prism operating system, it would have had to stop the session and open a new probe, says Bartling. SGI then combined the two into the same probe for a total of 400 gigabytes of data.

"Now you have all the geophysical data telling me about structure and rock properties and the amplitude volume and I have superimposed on that the continuity volumes emphasizing where the edges are," he says. "We saw stuff in that combined rendering we have never seen before." Without this type of system, the interpreter would not be able to do that, says Bartling. "They would probably do without, which leads to dry holes and sub-optimum recovery from the reservoir."

SGI specializes in building computers with a number of processors (similar to clusters) but only one operating system and large amounts of memory (up to four terabytes) required for scientific computing. "Our customers are trying to visualize models in the hundreds of gigabytes or even terrabytes in size," says Bartling. "To do that, you have to put data into memory."

A PC graphics cluster for a 400 gigabyte visualization project would require 512 processors, 256 Linux nodes in a cluster, 256 copies of Linux, 256 graphics cards, 256 distinct two-gigabyte memory caches and a "gigantic" router switch -- "not to mention a pretty talented systems administrator," he says.

For a comparable operation using the Prism, 512 gigabytes of memory can be added to one node without adding to the rest of the operating system because only a single copy of Linux is required. In addition, 32 processors and four graphics cards would be required. "All of a sudden we have the ability to provide a highly affordable and scalable system configured to perform the task, saving a tremendous amount of money on just the cost of graphics cards [$5,000 apiece] alone," says Bartling.

COST SAVINGS. Persons using Prism can also use the graphics cards as a visual serving environment, to push views out to conventional desktops. The use of a visual serving protocol, Visual Area Networking (VAN), can provide the power of a supercomputer at a desktop, rather than requiring the operator to go to a visualization centre. The VAN technology also works across a wireless protocol, supporting high performance remote visualization. For example, workers on a rig with access to a wireless network are able to interact with the data that is back at the office running on the Prism machine. This collaboration is especially useful when what the drillbit is encountering is different than what had been anticipated, says Bartling.

European customers in particular are using visualization systems for long-reach horizontal wells in the North Sea. "If the geology is not quite right, usually they get to bottom, plug it [the leg] back and buy $10 million worth of concrete," he says. With a collaborative and interactive environment between the rig and the office, it is possible to recalculate the well trajectory as it is drilling, eliminating the need for a redrill. "Because you are now sharp shooting the position of those wells in the reservoir, you are able to put them in a place where you can add a huge amount of recovery to that well that you wouldn't otherwise be able to," says Bartling.

Statoil, a customer in Norway, estimates that by using these methods it can earn another $375 million from its wells in addition to saving about $20 million in drilling costs, he says.

While visualization systems have typically been used for exploration and asset management, the latest trend is remote operations centres, especially for offshore operations. In its head office, a company can build an operations are connected to the office via data links. The result has been increased efficiency and improved health and safety as fewer persons are being flown to the rigs -- sometimes an expensive and risky operation.

A major advantage is that the centres can bring operations and reservoir management personnel together with their data in the same facility, encouraging operational decisions based on reservoir performance, says Bartling. "The real-time aspect is a real breakthrough," he says. "A lot is happening because we are bringing data into these facilities whereas before we used to stick it in the databases and look at it every 10 years, not in real time."

The difference between real-time and historical data can be compared to that between surgery and an autopsy, he says. "With real time, you can intervene with the process to make it better rather than looking at it 10 years later and saying 'If only we had done it differently.'"

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