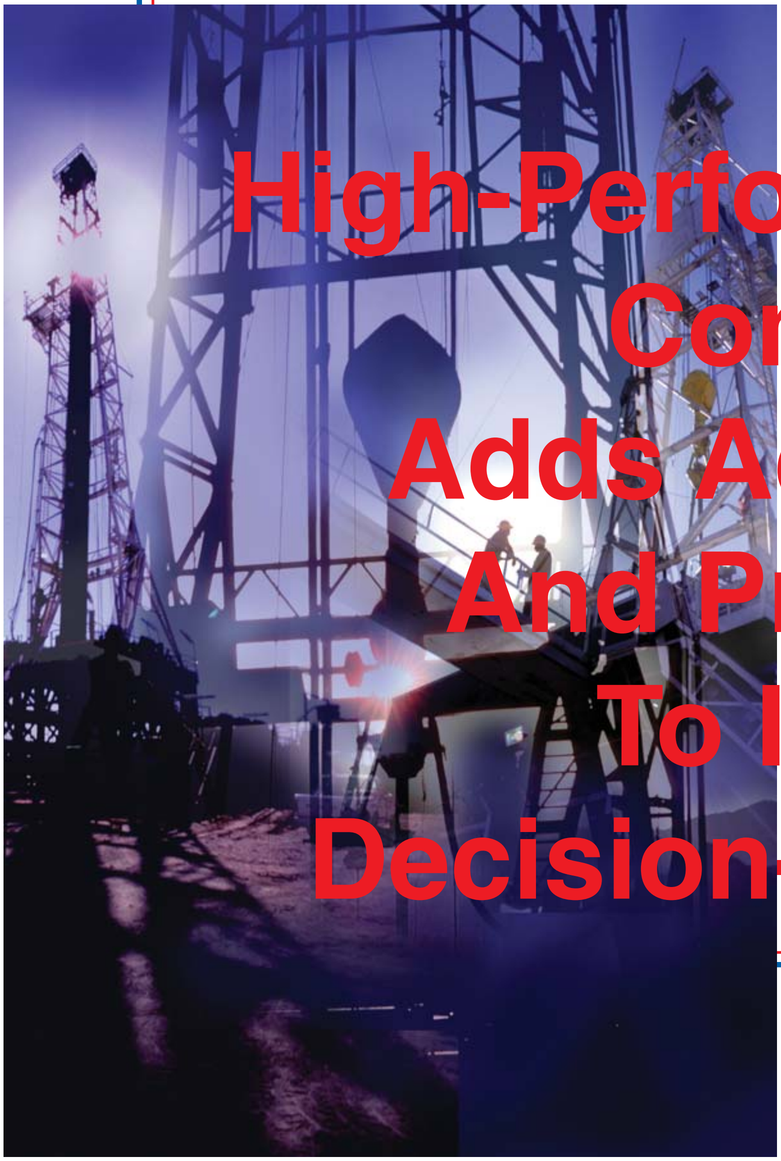
THE AMERICAN OIL & GAS
REPORTER®
JANUARY 2003
The "Better Business" Publication Serving the Exploration / Drilling / Production Industry

2003 TECH TRENDS



High-Performance Computing Adds Accuracy And Precision To Industry Decision-Making

Computing Capabilities Key To Managing Business Trends

By Bill Bartling

MOUNTAIN VIEW, CA.–Business drivers in the oil and gas industry are producing important technology trends that will affect the next 10-20 years in exploration and production. The drivers are financial, with companies emphasizing margin over production and recovery factor over discovery success. Asset rationalization will increase, allowing major players to shed underperforming assets to smaller companies with less overhead, thereby improving the bottom line of both categories of companies.

A major key to achieving this will be collecting, transporting, analyzing, understanding and sharing vast amounts of new types of data to model the real-time behavior of the subsurface. Real-time analysis allows timely intervention into operations that if left running suboptimally, would irrevocably deflect the trend toward the negative. The technology to define and support this will offer a catalyst to new efficiencies, achieved in the shadow of increasing cost, increasingly distributed and limited technical talent, and flat commodity prices. These technologies must first pay for themselves with operational savings, and second, leave the substantial gains from improved recovery and higher production rates undiluted by new infrastructure investments.

Larger companies have been aggressively investing in high-performance computing and visualization technologies as key to not only exploration, but also to increased production from new and existing wells as supercomputing, long-distance collaboration, networking and desktop capabilities continue to expand. Independent companies will see important gains in access to information and the technology to use it cost effectively. The major multinational and national companies are promoting the full automation of oil and gas fields, remotely managing complex and hazardous operations through robotics, real-time data acquisition and analysis, and large-scale collaborative visualization.

But the main business driver remains consistent: the need to analyze larger and larger data sets to add accuracy and precision to very expensive decisions.

Expanding Data Volumes

One way to increase economic productivity of oil and gas fields is to add data derived from producing wells to the analysis and decision-making process. Data volumes on producing fields have grown exponentially over the last decade, from tens of megabytes to the point where geophysicists are now commonly working with tens of gigabytes of data. The only effective way to analyze these massive data volumes is in large-format visual environments. Understanding 100 gigabytes of data in a spreadsheet format is very difficult, but analyzing the same data in a visual format is easy and time efficient.

Drilling success rates have increased dramatically with high-performance computing and visualization technologies, especially in exploration, where a 10 percent success rate has been the historical average at most companies. Using high-performance computing, some companies are now recording exploration success rates as high as 70-80 percent!

Data reprocessing is a dominant trend in the industry. Seismic data provide primary information that can be reprocessed to create attribute fields, and a number of companies are creating secondary processing systems that create new seismic volumes from legacy data sets. These data are the cornerstone of the new business model and act as digital guides to geological interpretation and reservoir modeling.

The process starts with an amplitude seismic volume 1-10 gigabytes in size, and then adds one or more attributes relevant to the physics of the reservoir, creating a new computational solution and increasing the volume size proportionately. Calculating a third attribute results in a commensurate increase in the volume of information and even more value to the management of the operation. This is currently done using batch processing as well as real-time analysis in visualization applications that have the ability to attach attribute-calculating algorithms to interpretive probes. Each of these newly created attributes offers new insights into the characteristics of the reservoir.

New Technology

New technology that passes a cube through seismic volumes is now part of virtually all advanced visualization packages. This capability has rapidly become a standard part of the interpretation process, accelerating time to decision by orders of magnitude. An algorithm can be associated with moving the cube so that the volume computes another attribute, adding additional decision-relevant information with each new attribute, all the while increasing the size of the overall data volume. All the data are stored in the memory of the computer and visualized in real time, typically in large-format, theater-type rooms. Adding full immersion to these environments expands the interpreter's scope and further accelerates his ability to derive critical insights from the data.

High-performance processing, visualization and 3-D applications have greatly advanced interpretation capabilities from 10 years ago, when interpreter's still had to make numerous assumptions about reservoir rocks and the types of fluids they might contain. Today, earth scientists have actual measurements that can provide direct information about the reservoir, and tomorrow they will have real-time views of how fluids pass through reservoir rock to the well bore and up the casing, and even on through the pipeline to the refinery.

Simply put, the industry has advanced from assumption to knowledge, and operators are now applying that knowledge to take appropriate actions to deliver significant new financial gains. High-performance computing and visualization provide the infrastructure for rapid model updates, analysis and collaboration, leading to more effective decision-making and resource allocation in exploration and production management programs. The net result is increased returns on capital investments by drilling fewer wells to access more oil and gas and better managing the reservoir to recover additional hydrocarbons.

Future Trends

Automation, including having robotic equipment on the platform remotely managing oil fields–especially in hazardous environments–offers a number of advantages. Automation takes people out of harm's way, but more importantly, it allows fields operations to be managed much more effectively by using real-time data and modifying the behavior of fields using feedback loops to the robotic equipment.

This is part of a vision for the future that is now coming together, with many companies developing prototype products or early releases. Clearly, the deployment of subsea completions has been greatly aided by remotely operated vehicles, and new capabilities are on the horizon. The ability to utilize robotics for operational support is gradually becoming reality, step by step.

In the future, many wells will be drilled and produced by remote command and control, with digital video cameras and digital sensors providing views and acquiring information that will be handled by high-performance computing and large-scale visualization technology, allowing remote management and operation as new data are acquired. Along with evolving trends in robotics and remote operations, next-generation sensors and communications structures are also developing rapidly.

In line with Moore's Law, which predicts that the power of computing technology will double every 18 months, computational capability continues to grow remarkably both on the desktop and in the computing room. In addition (and principally because of the computer gaming industry), the industry is seeing impressive advances in graphics technologies, focused mainly on fast polygon computation and rendering.

As accurate as Moore's Law has proven for processor speed, however, it has not held true for system architectures, where performance as measured in application throughput has not kept pace with CPU clock speed. As a result of the disconnect between processor speed increases and system architecture standards improvement, supercomputing continues to be strong in parallel, and the advent of 64-bit Linux™ systems in a variety of forms will push the envelope even further.

While the CAD/CAM world moves to commodity desktops, the scientific, technical and engineering markets–where mission-critical activities are commonplace–still rely largely on high-performance machines for two reasons: the superior quality of the graphics (especially in realism), and overall performance (both speed and the amount of memory used to produce full-motion models) compared to desktop alternatives.

Graphics-Serving

Moore's Law suggests that achieving the capabilities of supercomputers on desktops is inevitable, but Moore's Law also applies to supercomputing. So the desktop, no matter how fast and good it gets, will never be as good as a supercomputer running graphics and other computationally intensive tasks. Nevertheless, users still like to have as much capability as they can on the desktop. For graphics, this means moving to graphics-serving systems that provide a robust ability to deliver the capabilities of the graphics supercomputer to the desktop, serving images across either broadband or local- or wide-area (LAN or WAN) networks. This capability gives a desktop workstation user more performance capabilities than anything his machine could ever accomplish on its own.

A key factor driving this strategy is the cost structure of the computing environment. Information technology managers are reluctant to pay premiums for high-end graphics machines for every desktop, in spite of the fact that engineers and scientists require them to do their work. The solution is to provide the appropriate level of technology to the task and leverage the investment in high-end systems by concentrating graphics capability in the computer room, and then providing images to the desktop on an as-needed basis.

Today's model of graphics delivery is to work inside a LAN, but this is rapidly evolving into long-distance graphics delivery as well. While images can be sent from Houston to Kuala Lumpur, network bandwidth limitations make delivery comparatively slow. However, new software solutions are being created that take full advantage of existing networks, and with the cost of broadband steadily decreasing, long-distance graphics delivery capability is coming into sharper focus. As these two main elements of the communication bottleneck are resolved, companies wanting to connect experts around the world can use distributed graphic-serving technology to cost-effectively bring people together across vast distances for real-time collaboration and visualization.

High-Tech Solutions

Smaller independent oil and gas companies, which typically do not have the capital to invest in supercomputers, can access high-tech computing and volume graphics solutions using application and data service providers (ASPs/DSPs).

Graphics serving can provide very high-end supercomputing applications and data views to independents on a time-fee basis. A few large, integrated ASPs are beginning to offer these services based on graphical serving. Soon, a small independent will be able to log on to an ASP's computers and pay a fee based on computing time used. DSPs provide "pay-per-view" access to substantial amounts of data, and store and manage an operating company's proprietary data on a contract basis. These kinds of business models give smaller operators the ability to compete with much bigger companies without having big-company capital resources. In fact, even the largest oil and gas companies may eventually adopt the ASP/DSP model to preserve capital and reduce the cost of 3-D reconnaissance.

Halliburton and Schlumberger, among others, have strategies underway to provide customers with data and applications in ASP and DSP formats. The benefits of

these services are equally applicable to smaller producers as to major integrated or national oil companies.

In addition, ASPs/DSPs provide access to online networks of consultants and experts with substantial specialized skills and field experience, allowing independents to leverage the Internet to bring the best available data, applications and expertise to their projects. And ready access to oil and gas experts is become more important all the time given the growing personnel crisis in the industry.

The average age of an oil and gas company scientist is the mid- to late 40s. The majority of the workforce–including the most knowledgeable personnel–at the typical oil and gas company is quickly approaching retirement age, and there are not nearly enough trained graduates coming out of the nation's universities to offset the loss. This is causing a lot of stress in corporate boardrooms: How can a company continue to be a capable, technical-based organization when the bulk of its technical talent is removed?

In response, companies are increasingly using computers to capture their work processes and experience bases so they can be applied to future processes. Where an employee may have once worried about whether he would one day be replaced by a computer, corporate executives today are concerned about whether that person's skills can be replaced by a computer. It is a reality that companies will soon have to face, and modernizing their internal technology infrastructures will help them prepare for the day when they cannot hire enough qualified people.

High-performance computing and visualization technology has already proven a major force in advancing the industry's financial performance by increasing exploration success factors and optimizing operations. Looking forward, the future will increasingly depend on advanced computing systems to enable companies to capitalize on their existing assets as much as possible with a declining technical workforce. The good news is that technology can provide the infrastructure to manage the explosion of data underlying the new business methods, coupled with the ability to analyze, view and share data among disciplinary experts.

These advances will not be isolated to the office, however. The long reach of technology continues to make the world smaller by the day, and is extending into the planet's last great frontier: the deep ocean, where new major discoveries are being found. In addition, these technologies will turn all operators into "day traders" by nature, supplying real-time operational information that is fully updated into operational decision models and managed by centralized systems that are connected to the world. ❒

BILL BARTLING

Bill Bartling is director of global energy solutions for Mountain View, Ca.-headquartered SGI, responsible for the company's strategy and position in the oil and gas industry. Before joining SGI in 2001, he was president and chief executive officer of SciFrame Inc., a provider of collaborative software solutions to the energy and pharmaceutical markets. Prior to SciFrame, Bartling was manager of technical computing for Occidental Oil & Gas, where he set strategy, architected solutions and implemented E&P technology to pioneer the use of collaborative volume earth models in large-format visualization centers. He had previously served as senior vice president, software engineering, for CogniSeis Development, and also spent 15 years in exploration, production and research with Chevron Corp., involved in using, testing and designing computer interpretation and analysis products. He holds a B.A. in biology from the University of California at Santa Barbara and an M.S. in geology from San Diego State University.