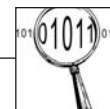


Next-Generation IT Solutions Aimed at Alleviating Challenges In Managing Corporate Knowledge

By Barry Irani, Oscar Teoh and Ben Parker

HOUSTON—During the next five years, more exploration and production data will be generated, gathered and stored than all the historical data to date. Technological advances in data capture, transmission and storage provide today's oil and gas workers an overwhelming amount of data to manage and use. The situation will only get worse with time as data volumes continue to grow. And this comes at a time when a large segment of the knowledgeable workforce in the upstream industry is approaching retirement. As a result, oil and gas companies must do more work than ever with fewer people.

To overcome these challenges, exploration and production companies are turning to new information technology and different ways of thinking about and managing information. Revolutionary approaches to data access and new software tools to present and visualize data enable companies to improve operational efficiency and boost productivity. New proven, Web-based applications also are emerging to help the petroleum industry retain and transfer knowledge within its workforce.



Oil and gas facilities today generate a vast and diverse amount of technical data throughout the entire asset life cycle. A good example of this is a deepwater production facility, which is capable of generating many terabytes of data in a single year. Given the high-value and safety-intensive nature of such an asset, monitoring its operation and performance is critical. To that end, facilities are being outfitted with sensors wherever possible to provide real-time data on their operations and complex systems.

For example, sensors read and record pump and compressor pressures to provide valuable information on equipment integrity. Typically, these measurements are taken every one to three seconds, providing a steady stream of information. Advances in sensor technology enable sensors to be placed on components that require a much greater measurement frequency. Monitoring moorings and risers, for instance, requires measurements to be taken 20-30 times a second in order to detect relevant variations in these components.

Data from offshore platforms and facilities are making their way faster than ever into the hands of asset teams, giving them unprecedented data access and analysis capability. Improvements in communication between offshore and onshore have resulted in transmission rates thousands of times greater than satellite communication. For example, the deepwater assets of one major petroleum company are being linked together with a subsea fiber network that keeps them connected and in constant touch with onshore personnel, providing real-time communication and critical data sharing—even in the face of a hurricane.

Impeding Decision Making

Ironically, the same technologies that are designed to improve operational awareness and efficiency are, in fact, paradoxically impeding the decision-making process among asset teams. Simply put, the stream of exploration and production data has become a river. Engineers, geoscientists and managers now spend much of their time finding and organizing the information they need to make sound decisions. Systems and solutions aimed at solving problems are focused and application-centric, providing a few specialized users the access they require, but effectively locking out the rest of the asset team or other nonspecialized users.

The result? Exploration and production data systems are isolated, spread out and difficult to access for all but a few. Tapping the wealth of exploration and production information, combining it with other data sources, or sharing it across the enterprise is virtually impossible.

Apart from data management or IT staff who directly work with data systems, a user must access the exploration or production data he needs through software applications specifically designed to retrieve and present information in ways that make sense to the user's functions in the organization, such as reservoir engineering. The focused, yet narrow, nature of these applications is a legacy of two trends.

First, oil and gas industry IT departments have taken on a service provider role to the various functional areas within an oil company: drilling, production, exploration, land, marketing, etc. IT departments have delivered solutions and systems that meet the specific needs of these functional areas with little emphasis on how such systems may exchange data or otherwise interact to allow other nonspecialized users to share information.

Second, exploration and production information systems across an oil and gas company remain disparate from and incompatible with one another as a result of traditional approach-

es to software application design and architecture. A traditionally designed geoscience application, for instance, is essentially a silo of information unto itself with data access and presentation tied together. Therefore, other applications, such as drilling or engineering packages requiring common data residing in the geoscience application, cannot access the data directly.

Revolutionary Technology

One of the most revolutionary yet underappreciated technologies evolving to solve the problem of data exchange is services-oriented architecture (SOA). This technology breaks from the traditional method of application development by allowing data access and presentation to be decoupled. As the name suggests, SOA is a framework on which applications can be built. The framework can be used to provide an interface to exploration and production data through the network.

Applications built on SOA can consume the services without having to worry about the underlying data systems and platforms. With this approach, the dozens of information systems that have historically been separate and incompatible are now capable of being exposed through services as cross-platform, reusable data sources. Organizations will have more flexibility than ever to quickly connect users with the information they need no matter where it resides in the company.

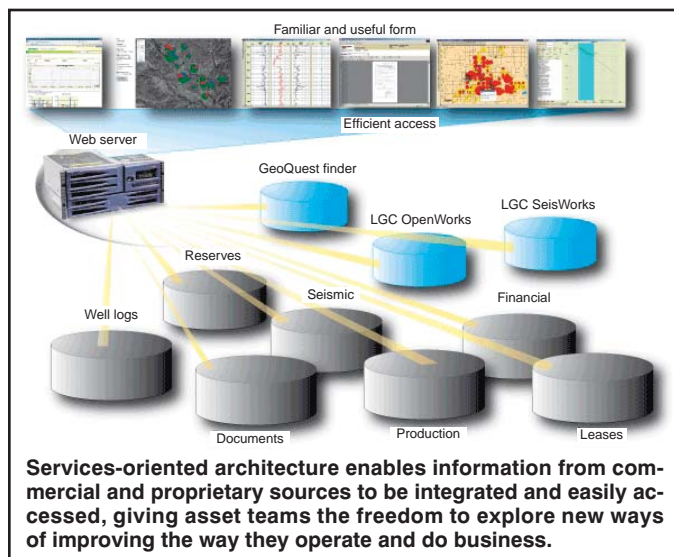
Applications that take advantage of SOA are typically Web-based, allowing them to be accessed from virtually anywhere and anytime. Some portal systems take full advantage of SOA, enabling exploration and production data to be combined from multiple disparate data sources into a single access point. Other proprietary and commercial data made available through Web-services can also be combined in ways never before imagined. The net effect is that information from all functional areas of the enterprise can be easily integrated, organized and presented to users in a form that makes the most sense to them—freeing them from the task of finding and manipulating information, and allowing them to focus on core business activities instead.

SOA makes possible new ways of combining, presenting and visualizing information, providing asset teams the freedom to explore new ways of improving the way they operate and do business. In addition, Web-based data visualization and GIS systems can give users a powerful interface to unify and visualize exploration and production information in context. Using these systems, data such as well spots and production roll-ups can be combined and overlaid with a host of cultural, operational and other relevant data to form a comprehensive picture of an operating asset. The combination of information from dozens of sources, presented in context, enables users to utilize information faster and more intuitively, dramatically improving the decision-making process.

As an example, a major oil company operating in the Gulf of Mexico has created a crisis management center around SOA. The system combines 25 diverse data sources, including geographic data, hurricane and weather tracking, pipelines, platforms, satellite imagery, and employee locations. In the face of a storm, and even under normal operating conditions, this cohesive view of a company's assets and people gives asset team members the intelligence they need to make informed decisions faster from wherever they are located.

Capturing Employee Knowledge

Within the next five to 10 years, many of the industry's most knowledgeable workers will retire. They will carry with them a wealth of knowledge, experience and specialized know-how,



much of which has not been captured in a systematic and meaningful way. The aging of the workforce comes at a time when universities are turning out fewer and fewer graduates in the disciplines oil and gas companies need. This “brain drain” in the industry also coincides with the growing demand for energy. To meet global demand, the industry must increase its capability to capture and transfer knowledge within its shrinking and widely dispersed workforce. But given the highly specialized and multidisciplinary makeup of employee knowledge, doing so has historically been difficult.

The challenges remain capturing employee knowledge in a way that is nondisruptive and fits into day-to-day processes, and connecting the right information with the right people. To meet these challenges, companies are turning to some unlikely sources.

Interestingly, several Internet technologies are providing much inspiration for knowledge management solutions. The widespread appeal and impact of Web sites such as MySpace, YouTube and Wikipedia demonstrate that large-scale, information sharing and exchange succeeds where corporate systems have faltered. Why?

Web sites such as these are highly decentralized and succeed through massively distributed collaboration. Perhaps the best example of this is Wikipedia, an online encyclopedia managed and organized by its users around the world. The technology behind it, often called wiki technology, enables users to simply and freely publish, edit and organize Web pages. The result is a dynamic, ever-changing pool of shared information.

Such a simple concept has enormous effects on collective knowledge. The distributed nature and ease of use of wiki sites facilitates collaboration and encourages democratic use of shared resources. Users with little or no technical ability can easily contribute their knowledge where it is instantly open to review, correction and validation by others. Moreover, because content is also organized by users, finding information stored in a wiki system is intuitive.

Common Purpose

In addition to allowing users to collaborate on a dispersed, large-scale basis, other sites that employ social software enable users to form communities unto themselves. Even as “virtual” or online communities, these systems foster a sense of common

purpose or interest. They appeal to each person’s innate need to be part of a social group and allow users to form social networks.

The scope of the common interest shared by a virtual community may be narrow (such as a developer network devoted to open source software) or broad (as in MySpace, where the common interest is the community itself). But no matter the scope or common purpose, members of virtual communities contribute their time, energy and skills without tangible rewards. For example, a person who keeps an extensive online journal or blog so that others can benefit from his special knowledge on a technical subject does so voluntarily and without a paycheck.

Individuals are active members of online communities for many reasons, not least of which is reciprocation. In other words, the motivation that if a person contributes his valuable information he will benefit from others’ contributions in the future. As researchers such as Peter Kollock have shown, increased recognition and a sense that one can “make a difference” in the group also plays a role.

So how can virtual communities and distributed collaboration technology benefit the industry? In today’s environment, employees are widely dispersed and new workers come onboard or move on more than ever before. Exploration and production teams are assembled and reassembled to meet the demands of regional plays or licensing rounds. With such a fluid and constantly changing workforce, knowledge management technology must adapt to fit the changing people and process dynamics.

Simply translating these consumer Internet technologies into corporate solutions is not enough. Business requirements such as security and data quality must also be addressed. Even in the largest corporations, “massively distributed” is a relative term when comparing thousands of employees to millions of Internet users. Yet, where the technology cannot be directly adapted to the workplace, guiding principles can be distilled for building the knowledge networks corporate users require.

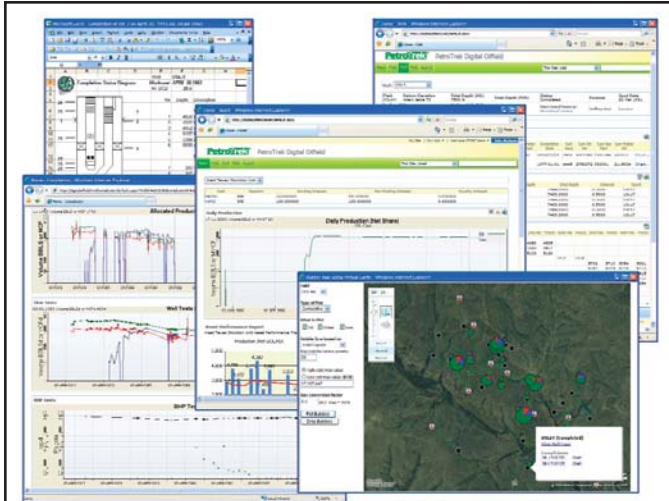
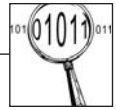
Addressing the unique exploration and production knowledge management complexities means decentralizing solutions and making them easy to use. So instead of depending on a few experts to contribute toward a corporate knowledge base, all workers can be given access to the collaboration tools they need and empowered to contribute. As wiki technology demonstrates, when users are able to simply add, edit and organize information to a shared resource, collective knowledge improves along with ease of access. And as virtual communities have shown, building a sense of community encourages voluntary participation and high-quality information contributions.

Next-Generation Tools

New information management technology is emerging to deliver these capabilities to the enterprise. Commercial solutions, such as Microsoft SharePoint™, provide next-generation distributed collaboration tools, including Web content management, blogs and wiki sites.

These types of solutions not only assist companies with capturing and organizing employee knowledge and experience, but they can also assist in creating knowledge networks. Because social networks link people with widely differing skills and knowledge levels, solutions that incorporate this type of technology can better connect knowledge seekers with experts and the right information.

Some products take the technology further by automating



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the process of who-knows-who and who-knows-what, transforming social networks into knowledge networks. By sifting through e-mail and instant messages for common terms, these systems automatically expose areas of knowledge and expertise within an organization. Users can then quickly search for and leverage that knowledge. For example, a geologist who requires specialized knowledge in an unfamiliar geological basin can simply search the knowledge network to quickly find a colleague with the right information.

Information and knowledge management challenges in the oil and gas industry have never been greater. The changing workforce is leaving companies with a shortfall of skilled and knowledgeable workers at the very time the industry is facing record demand for energy. Workers who remain must wade through a rising tide of data, requiring them to work harder than ever simply to stay even.

Yet these challenges also present the industry with a valuable opportunity. Solving the challenges of data access and knowledge transfer can be accomplished by combining business processes, people and the right IT, while at the same time improving the quality of work and decision-making. Commercially available solutions such as SharePoint can bring together the information access and presentation users need to effectively collaborate and share knowledge. The result is a synergy of people and information. The benefits are clear. Oil and gas companies are achieving higher productivity with a leaner, more connected workforce. □



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