

Technology Opens New IT Capabilities

By Mike Brulé

HOUSTON—Service-oriented architecture (SOA) is well known in the oil and gas industry, but has had to evolve to simpler forms to enable its practical deployment and to have faster business impact. Software as a service (SaaS), an evolving form of SOA, has only begun to take hold in oil and gas, even though it has been rapidly expanding in other industries for several years.

In the exploration, drilling and production industry, SaaS can play a prominent role in distributing software-based services to remote and harsh drilling and production locations. However, SaaS has much wider implications in how efficiently these services are built, aggregated and delivered. SaaS enables expert-specialist software companies to provide broader on-demand and automated services, aggregated and connected by the Internet, and delivered to many companies in a reliable, high-performance and secure way.

SaaS has taken the information technology world by storm, and it has been applied in a variety of ways in other industries. In oil and gas applications, early SaaS systems have enhanced and modernized oil field operations and business services, and more advanced SaaS systems are now being applied in drilling and completion operations.

Much has been said about SOA as the dominant distributed computing paradigm for developing and delivering engineering and business applications all over the world. The huge field of SOA with its blizzard of techno-acronyms has been promoted in IT circles for more than a decade. However, in the oil and gas industry, SOA's value is still not de facto,

and oil and gas company executives still have to be convinced to approve SOA projects for delivering new IT capabilities that can help make decisions, run operations, and speed business changes.

In other industries, the SOA debate has evolved beyond accepting SOA's value to how it should be implemented. Evaluations by IT analyst firm Gartner Group, which coined the term "SOA" in 1996, indicates that traditional SOA has not made the inroads that were expected. The main reasons include a lack of corporate governance (i.e., different business units pursuing disjointed SOA projects), slow progress toward interoperability standards, high upfront costs for an enterprisewide SOA infrastructure, and long time-to-business impact.

Easier SOA implementation and deployment approaches have been sought on the path to traditional, more difficult and costly implementations of SOA, so that business can benefit more quickly. These evolutionary "retrograde" SOA approaches include Web-oriented applications (WOA), which are SOA implemented mainly with Web principles and also often employing composite-application "mashups," which integrate application silos in a Web-based portal at the interface level.

New Web technological capabilities, often represented by "Web 2.0" and "on-demand cloud computing," keep evolving at a dizzying rate. Web 2.0 represents the constant new waves of lightweight, interactive, online, social and collaborative capabilities that are being created and used to transform applications on the Web. SaaS is a part of a convergence of established SOA technologies (WOA, event-driven SOA, or traditional SOA) with newer Web 2.0 technologies (e.g.,

mashups, such as those created with Microsoft SharePoint[®] and Virtual Earth[®], and lightweight languages and interfaces such as REST, JSON, AJAX, AIR, and Silverlight[™]) to provide a dynamic and collaborative smart Web application.

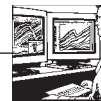
To understand how SaaS can be valuable in exploration, drilling and production operations, it is helpful to focus on how SaaS has been implemented with the WOA form of SOA, which has become the most practiced in the oil and gas industry because of its early successful business impact.

Fundamental Business Asset

In spite of the difficulty in sorting out what oil and gas companies can achieve with SOA, managers and executives can be sure of one thing: SOA has to provide data integration and accessibility for operational transparency and decision making 24 hours a day, seven days a week. Data are a fundamental and foundational business asset, and reliable and timely data are needed to make operational decisions to monitor impending problems and optimize operations.

Studies by the Society of Petroleum Engineers' Oil Field Integration and Real-Time Operations subcommittees confirm in statistical detail that half of an engineer's or a geoscientist's time is spent in the non-productive, tedious activity of finding and assembling data, before ever making a single decision that actually progresses operations. This nonproductive time, let's call it the "data commute," is a major problem in the industry because it effectively halves the work that can be performed by an already dwindling workforce.

To understand how WOA and SaaS can help reduce the data commute, it is



necessary to understand a little more about WOA versus traditional SOA. Both are complementary architectural approaches, but WOA is resource-oriented (e.g., useful for easily exposing data in a meaningful context), while SOA is service-oriented (useful for providing a business function that is reusable by many applications). WOA uses a World Wide Web standard called representational state transfer (REST), and works on the interface level to expose data-focused services to the user, while SOA works on the more complicated system level to provide a broader range of services.

Amazon.com is a good example of a company exposing detailed data through WOA-REST. Users can simply click on an Amazon.com REST uniform resource locator (URL) to interface to Amazon's Web services through its simple Web API, and anyone, anywhere can access Amazon's vast product database. Many more details of the underlying design patterns exist, but the main point is that WOA with REST, although not as flexible as traditional SOA, is easier to implement and can provide many business improvement opportunities in drilling or production surveillance and optimization.

Oil And Gas Applications

Although SaaS has experienced a meteoric rise in many other industries, only a few toeholds have emerged in the oil and gas industry, primarily in drilling and production surveillance. Apache Corporation's Information Utility is a production-reporting system distributed worldwide over the Web to report key asset performance measures such as average daily and monthly production, water cuts, total liquids produced, lifting costs, realized revenue, profit/barrel of oil equivalent, and many others, including variance of actual versus planned measures and key performance indicators (KPIs).

One newer SaaS application built on Web 2.0 technologies is the WelleZ® data management system, designed to enable a dynamic, lightweight footprint on not just personal computers and laptops, but also on wireless devices such as BlackBerry® and pocket PC PDAs. Figure 1 shows a high-level architecture diagram for the system and how it combines Web 2.0 concepts for a lightweight footprint, and cloud computing concepts for secure and performance-tuned database and application hosting.

The system has many features of a modern SaaS application in that it serves multiple drilling operators, not just one company, but the software is efficiently and securely served from a single code base and database hosted on a centralized server farm at a highly reliable ASP.

The technology also takes advantage of Web services XML integration with Microsoft Excel™, a popular application that many engineers and technicians prefer. The "tear-off spreadsheet" allows an engineer to extract a report and analyze it on the side, without compromising the underlying data warehouse in the cloud. Microsoft has started calling this SaaS variant "Software + Services" with office business applications. The "software +" in this case is Microsoft Office®, which is already preinstalled on virtually all company desktops.

Because the application is built from the ground up as SaaS, its advantages include those of modern SaaS systems in established use in other industries. It enables easy anytime, anywhere accessibility to the application and its data repository over the Web through satellite or telephone broadband, with very little footprint on the client PC or laptop. The application continues to work in an of-

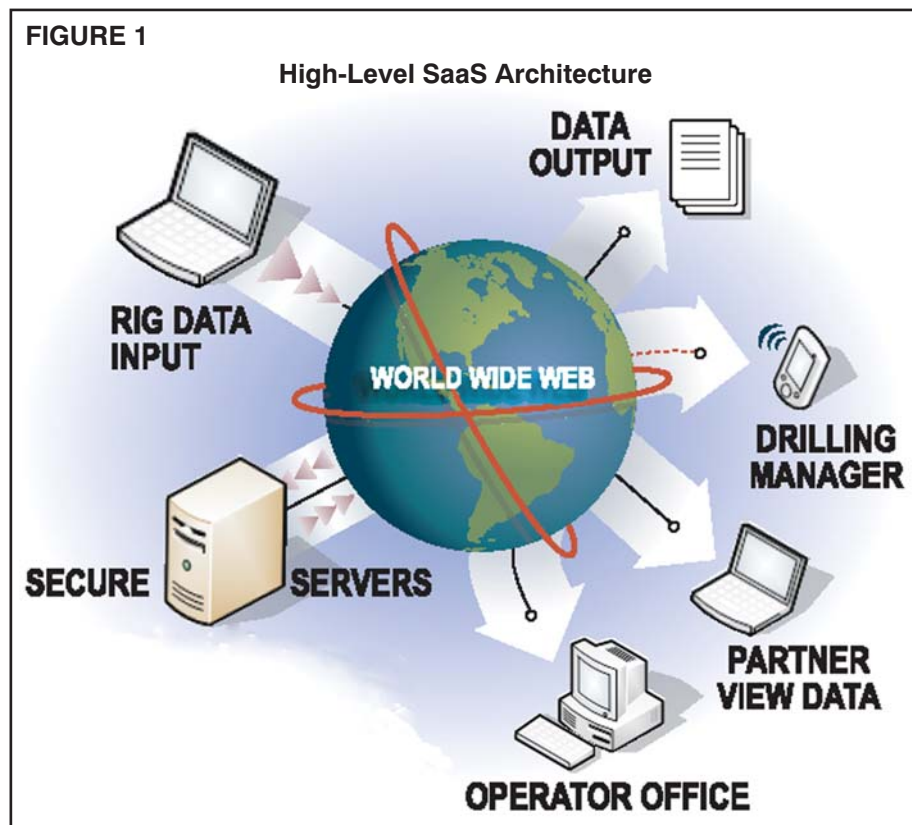
fline mode, allowing the loading of data, even with no Internet connectivity.

The SaaS application is fully capable of supporting a broad range of mobile wireless devices to receive and review rig activity reports, such as on a BlackBerry or Pocket PC. Device flexibility is a major advantage for companies running far-flung drilling operations in remote locations, and also can be tailored for company roles. For example, some drilling executives get their reports exclusively on their BlackBerry devices.

Lower Ownership Cost

The application offers easy upgrading to newer versions. It is enhanced and maintained in one central location, and hosted at a secure, robust application services provider. Plus, it is available with pay-as-you-go subscription pricing, with significantly lower total cost of ownership than if developed and maintained in house, or if purchasing and supporting a third-party application. Companies can use only what they need, and eliminate high upfront costs.

The secure, multitenant database can be optimally extended and performance-tuned for many types of data used by many clients. The company's data assets



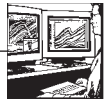
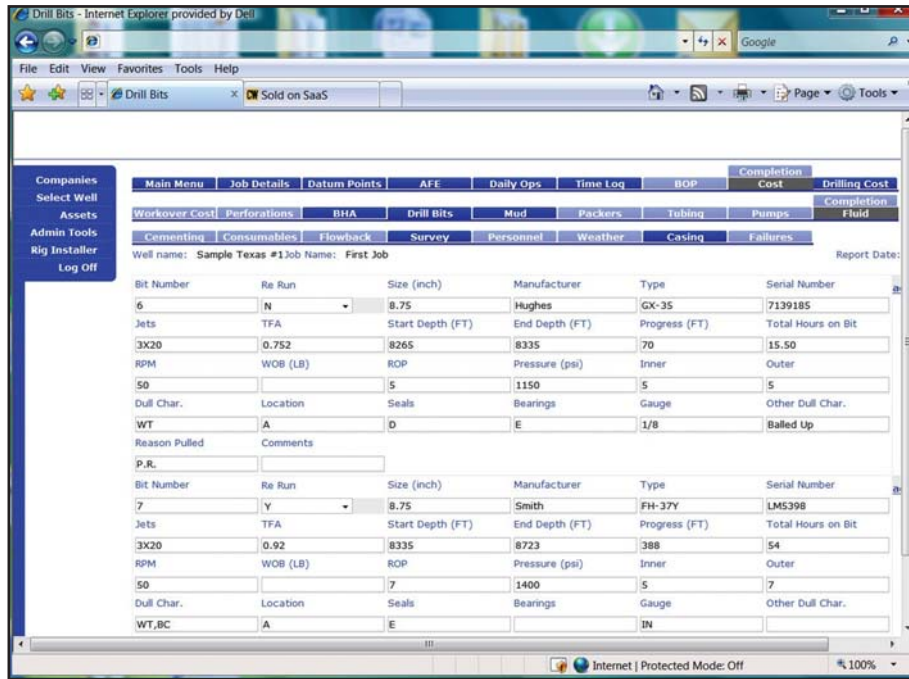


FIGURE 2

Input Screen for Drill Bits



are assured to be a single version of the truth, which is secure and mirrored for business continuity and disaster recovery. The SaaS provider maintains a concentration of experts in the application drilling domain and in software development, to make the application very easy to use, as opposed to having to maintain

in-house domain experts in multiple disciplines. The technology also allows a company to focus on its core business, rather than on software development. Such a SaaS application can be a viable component of a company's overall outsourcing strategy, resulting in lower total cost of ownership. Smaller drilling op-

erators with very lean staffs can leverage the same data capture, reporting and analytics power available to large operators.

Ease of deployment and ease of use are important additional ingredients that enhance transparency and help asset teams run more efficient, safer and profitable drilling and production operations. Figure 2 shows the SaaS application's very intuitive interface for entering the many kinds of data collected while drilling a well.

Major Advantage

One early adopter of SaaS in exploration, drilling and production is SandRidge Energy Inc. SandRidge owns and operates drilling rigs and related oil field services to focus on its exploration and production activities in West Texas, the Cotton Valley trend in East Texas, the Gulf Coast, the Mid-Continent, and the Gulf of Mexico.

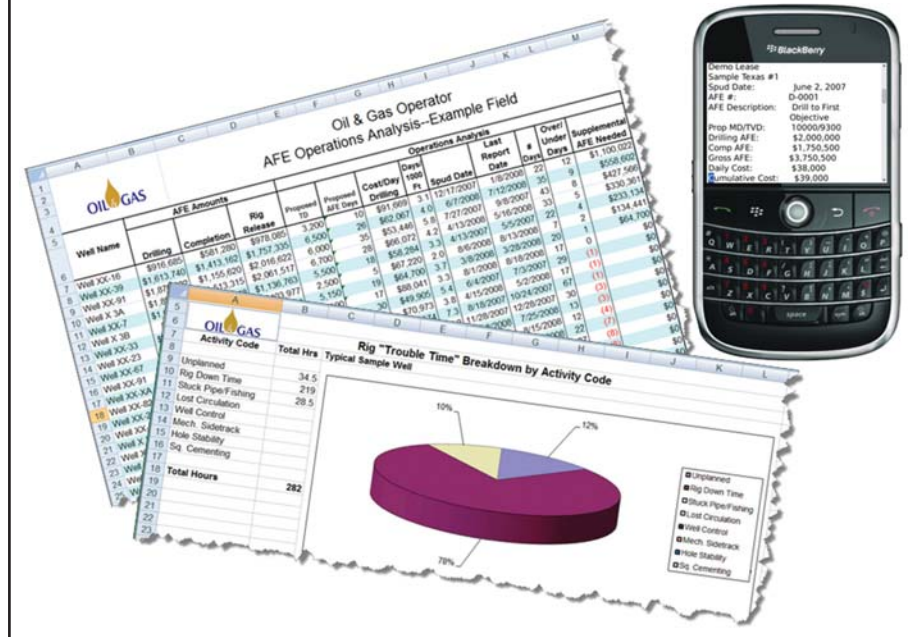
Jeff Nelson, drilling vice president, says Web-based uploading and data access to and from a relational database from any rig in a remote location is a major advantage. He cites the ease of use as among the technology's most essential features, especially when faced with constantly changing drilling consultants as they rotate in and out on each of more than 40 rigs.

"If we still had to deal with the old manual processes, pulling data from paper reports, we would have to do a lot more time-consuming training, which would require hiring even more people, and we would also be tying up a lot more of our drilling engineers' time," he says. "We must have a reliable system that is easy enough to use so that new hires can take over immediately on the rig and begin making drilling reports with few mistakes."

Although the application is built from the ground up on a modern SaaS architecture with lightweight components, the types of reports and their detail are not limited. Reports can be created as HTML pages or in desktop publishing-quality reports for internal operations and executive briefings.

Figure 3 shows a couple of the many possible tear-off spreadsheets that allow drilling engineers and rig personnel to analyze operations, determine wells for which field cost estimates are misaligned with authority for expenditures, or as historical data references to determine where the most trouble has occurred so that the next round of well planning is optimized.

FIGURE 3 Example Tear-Off Spreadsheet and Blackberry Reports





As SandRidge's Nelson puts it, "With high daily rig costs and the many millions of dollars we spend every day on operations, any areas that we can quickly highlight for improvement or speed-up to reduce rig cost, even if it is by only a few percent, are very worthwhile. We review our entire operations early every morning, and I like to review these reports on my Blackberry wherever I happen to be."

Enhancing Communication

Other report forms enhance communication with the field through graphical figures that are built dynamically on the data and are capable of live data drill-down. In drilling and completion, the well bore sketch (Figure 4) is one of the

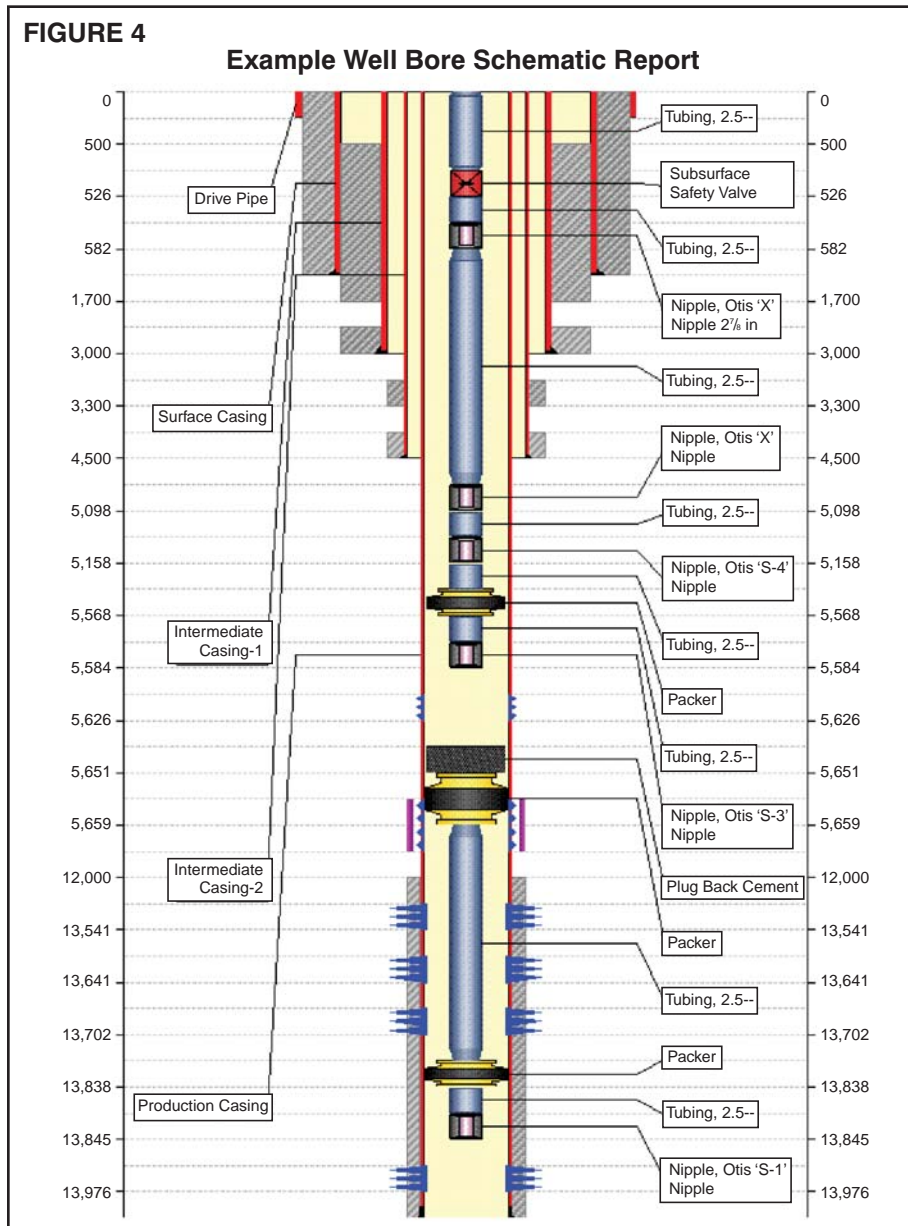
best known timesavers and productivity tools for the engineers doing the well design and prescriptive work. In the SaaS application, the dynamic well bore design visualization capability adds data quality checking capability by instantly showing the drilling or completion engineer where data are misaligned.

Most SaaS systems are focused on reporting data from operations. Operators find problems by poring over the historical data, thinking about why the problems were caused, and then improving their operations after the fact. They do not yet focus on modeling a decision concurrently and proactively while operational events are happening. Another form of SOA that is gaining momentum in SaaS applica-

tions along with WOA/REST is event-driven service-oriented architecture (ED-SOA). This technology is implemented with event-driven actions invoking a service or triggering a business process or human workflow.

ED-SOA is also emerging to move beyond traditional business intelligence measures and KPIs reporting for reactive decision making to operational business intelligence for predictive analytics and process modeling for proactive decision making. In drilling or production surveillance and optimization, the decision model could be added to work in tandem with the reporting model in the SaaS application system to support automated tactical operational decisions and human strategic decision-making.

This operational business intelligence and predictive analytics power, also known as the digital oil field, will continue to grow the impact of SaaS applications on exploration, drilling and production operations for the foreseeable future. □



MIKE BRULÉ

Mike Brulé is president of Technomation, an information technology consulting firm that provides enterprise solutions to majors, independents and service companies. He spent the first half of his 30 years in the energy business with Kerr-McGee and Shell working in North Sea and Gulf of Mexico field development and operations, and in alternative fuels research. Brulé is also a software development veteran who has been involved in developing more than a dozen integrated oil and gas application systems. He holds a Ph.D. in chemical engineering and an M.B.A. from the University of Oklahoma.

Editor's Note: The author would like to recognize the following sources:

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