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Progress in Integrated Operations Centers

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Abstract

Oil and gas companies increasingly require environments that support real-time E&P business processes, where wellsite information, applications, and experts can be linked with operational managers and decision makers in one place so that daily operational parameters can be viewed and decisions executed. Most companies believe that making decisions in real time while leveraging global resources and infrastructure will help to improve their field productivity while reducing costs.

Project team members are often collocated to ensure open communication and planning. However, since E&P activities often take place in remote and hostile parts of the world where it may not be possible or economical to deliver all the required resources and personnel, global operations with dispersed personnel frequently require such operations support centers to be "virtualized." Reliable and secure information flow is central to ensuring success in the contemporary oil field.

In a previous paper, the authors outlined the significant challenges of process, networking, security, hardware, and software infrastructure encountered in creating and supporting these integrated operations centers. These challenges include the end-to-end IT infrastructure such as wellsite and field IT, the design of the work processes to be supported, and the business model for company implementation.

This paper discusses some of the progress that has been made in meeting these challenges over the past year, with particular focus on the actual applications that support oilfield operations.

Introduction

Exploration and production companies are turning towards integrated operations centers as a means of gaining improvements in operations such as drilling and production, where access to real time data and analysis can lead to gains in productivity and efficiency. Operators and service companies have a range of strategic business activities that may be referred to as “real-time.” These strategic businesses need global, sophisticated systems with many elements of infrastructure to carry those business applications.

To organize these elements, the authors coined three phrases[1]:

Workflows that work

The design choices that are made in system development must be driven by the uses for which the system is intended. Different E&P operations are supported by integrated operations centers. They vary from interactive well operations such as wireline logging and drilling to monitoring operations such as production or equipment surveillance. The workflows necessary to support these operations must be well understood between the IT service providers and the end-users and domain experts.

Ready to run

Integrated operations centers are actually part of a complex end-to-end system covering remote data collection, data transmission and reception, data management, data processing and analysis, and remote visualization and interaction. To achieve the benefits, the system must be developed, configured, and delivered “ready to run.” The IT requirements as derived from the business requirements must be met and managed with a combination of IT tools and management practices.

Operating companies and associated service companies have extensive expertise in their core operating processes, and their staff personnel want to use such centers as a resource to improve their work processes, not as a classroom in solving information technology problems. However, because the nature of the data and processes used in these centers stresses IT capabilities, internal or external IT service providers must ensure that the centers support the core work processes. This

means managing the infrastructure elements so the performance can be predicted, and so recovery from unforeseen outages is sufficiently fast to be aligned with the business concept of "real-time".
Recovery from failure is probably the main criteria by which many users would judge success or failure of the operation. The duration of any network outage must be kept to the absolute minimum. The term "real-time" has also been described as "Relevant Time". Outages that might be considered minor during normal operations could be considered catastrophic during very critical time of operations.

Business model that makes sense
Introduction of new capabilities such as those in integrated operations centers must be done with proper attention to the business realities. Allocation of costs is one of the most important of these realities. In the old versions of centralization, IT infrastructure costs were simply allocated among business units, which had little control over the system and few incentives to manage its usage effectively. A new model must strike a balance between the simplicity of central control and the transparency and accountability of local control.

Progress
In the previous paper, referenced above, the authors concentrated on the challenges encountered in the implementation and operation of integrated operations centers, with special emphasis on the IT and business model challenges.
The authors emphasized a number of IT requirements necessary to deliver a 'ready to run' service. Those requirements included:

A Service desk function to ensure continuous system functioning and improvement
- Specified service level agreements
- Assured security
- Management of the end-to-end service

To fulfill those requirements, the system must provide
- A robust hosting facility, (which implies redundant connectivity paths, particularly to the Internet)
- A global ticketing system for managing job entries and operational problems
- A monitoring and management system for the servers and network
- A service to monitor and manage the application performance
- Standardization and use of best practices

The system elements needed include
- Data sources
- Input (feeder) network
- Server hosting
- Output network

The service elements include
- Helpdesk and single ticketing system
- Network and Server Monitoring and Management
- Performance Management Components
- Performance Management Services
- Security Services
- Staff to support the services

The authors noted that a 'business model that makes sense' would be neither centralized nor decentralized, but would rather be a hybrid model, where common costs would initially be reallocated to the business units, and where business units could buy products and services at well-known rates, and over time, could transition to a pay per usage model.
A global system that meets these requirements was cited as an example. This paper highlights progress made in the intervening year, and focuses more on the operational impact of such centers, enabled by the implementation of workflows.

Workflow Examples
Integrated operations centers, enabled by sophisticated connectivity, provide a new way of handling operations remotely. Various types of integrated operations centers are now in use throughout most operating areas and across different service units within the authors' company. Some examples follow.

Drilling Operations
More than half (55%) of all worldwide wellsite services from the Drilling & Measurements business unit are now monitored or directed from one of 47 operations centers. More than five million feet were drilled with operations through these centers in the first quarter of 2007 alone.

Despite reduced seniority of field crews, over 175 thousand pumping hours were performed on the business unit's tools and equipment, but the number of trouble tickets logged into the problem alert system remained unaffected. At the same time, there has been a dramatic increase in efficiency: Recently, one operating unit monitored 40 jobs on a single day from two operations centers with only two engineers. Over half of of the operating units monitor more than 75% of their jobs from operations centers.

Testing Services

In well testing operations, experts typically go to the wellsite to make decisions. Recently a Testing Services group conducted their first North Sea testing job in real time.

Given the operator's concerns regarding operational efficiency and the potential time needed for well cleanup, data was needed as quickly as possible. Data was provided in real time to assess well performance and enable operation decisions. The center also enabled collaboration between rig team, various, and customer representatives in cities across two continents. The original well test program was modified after monitoring well clean-up in real time, thus enabling the operator to make rig-time-saving decisions by confirming sufficient well clean-up with nodal analysis.

Quality assurance of data and dynamic interpretation in real time during flow periods were key factors in ensuring that the operator's objectives were successfully accomplished.

Drilling Optimization Services

The current pace in business and the shortage of drilling engineers has spurred the search for innovative solutions.

In one project, an operations center monitors five rigs. Operational data is analyzed and processed in the center. Any screen can be displayed in the visualization center in another city, where the project team is based. Most of the well design and operator contact also happens there. This concept to provide monitoring and remote operation capability from a central location and visual collaboration for project teams at a single location will soon be extended to other similar drilling projects.

The operations center initially consists of two "cells". Each cell is staffed by one directional driller, one MWD engineer and one drilling optimization engineer. Together the cell monitors and operates four rigs, although the number depends on well type and drilling environment. Soon, the wells will be steered remotely from the major center, further increasing efficiency. The cells are set up to accommodate additional expert engineers when needed.

In addition to managing wellsite operations remotely, the capability to remotely manage and administer computer hardware and software in the operations center, while providing collaboration capability with rigs and visualization centers, is expected to reduce costs and further drive efficiency.

Remote Support for Well Placement

In recent years, real-time capability has enabled experts to work closely within operators teams in their office rather than at the wellsite during a well placement job. This works well during daylight working hours, but handling this collaboration during the off hours is still a problem. Typically, experts interface with the operator and the wellsite from their home, hotel room or increasingly from an internal operations center. It is not always feasible to staff the centers with specialized expertise around the clock. Moreover, the demand for experts is often variable. Given this reality, the use of regional centers of expertise is being explored to optimize the use of scarce staff expertise.

In a recent project for drilling a horizontal well, an experienced domain expert was brought into the local office to work with the operator during the day. Support for the night shift was handed over to a remote operations center. This was seen as an opportunity to try out remote well placement and to identify areas for development of this technique for the future. While several areas for improvement were identified, there is clearly potential expanding this type of solution.

It is a lengthy process to effectively train and develop well placement engineers, and when staff is concentrated only in a single location, the workload tends to swing from high workloads to low. As the number of horizontal wells being drilled annually continues to increase, the industry will need new ways to manage growth. Remote support for well placement may provide the option to better leverage resources across operating regions in a way which improves the working environment for everyone.

Production Surveillance and Optimization

Production operations are not usually characterized by the same need for remote operations support as drilling operations, since production operations are typically not continuously manned. However, encouraging results have been obtained by centralizing experts to manage surveillance and lift optimization of wells in multiple fields.

Case studies have been completed for mature waterfloods in four different fields with over 60 wells. The economic impact of surveillance has been quantified through electrical costs, efficiency in fluid movement, and enhanced reservoir deliverability. The real-time data analysis for the entire field revealed opportunities to increase the production in the short-term, as well as the necessity to adjust the long-term exploitation strategy. The case studies showed the value of applying digital oilfield technologies in a cost-sensitive environment. Observations based on a large number of wells during a 2-year period show that 56% of the wells can benefit from some form of optimization, resulting in an average increase of 18% in production.

In one center, there are approximately 1000 wells managed from 90 different operators in 7 countries. The experts comprise a group of 11 people. Much of the progress was made because of integration of the usual elements of people, process and technology. The operations have been reported in detail in a recent paper.[2]
To summarize, a primary contributor to the success of the centralized surveillance and lift optimization service has been collaboration, including cooperation within the service company as well as between the service company and the operators. A coordinated organization is required to acquire data in realtime and turn this information into recommendations and decisions in time to be of use in the operations. The case studies in the referenced paper illustrate the collaboration between 8 different groups from 5 different business segments.

There are many challenges remaining, including developing efficiency in the process and in the supporting software, developing new workflows to extract information, and compiling information to perform single well and multi-well field optimization, but an increasing number of cases are demonstrating the value, and use of the concept is expected to grow in the future.

Wellsite Infrastructure and Data Delivery
Data in real time is required for drilling optimization, effective collaboration between teams, and operations centers. However, specialized IT skills are needed for data aggregation and transmission, and the provision of such IT services can distract wellsite personnel from their core activities.
To address the needs for wellsite infrastructure and data delivery, some service companies have developed wellsite IT services to support operations centers. In the authors' company, a new commercial service has been deployed, which delivers infrastructure and tools permitting data exchange, visualization, and collaboration between the rig and office in real time. This service supports internal services and also is being offered directly to oil company drilling operators.

The wellsite service combines the following components:
- Rig site multi-vendor data collection and transmission to a central hosting site with a single interface for all wellsite data providers.
- Drilling analysis software facilitating rig/office collaboration.
- Installation and support by IT engineers knowledgeable in drilling operations acting as a single point of contact for infrastructure reliability and quality issues.

Additional services include integrated operations center design, wellsite wireless and cost-saving integration with remote connectivity services. A central support and escalation matrix has been established to handle this new offering. A business model of the hybrid type discussed previously has also been established.
Initial market results are promising, and the demand for such service is likely to increase as oil companies seek the same improvements in productivity that a major service company has found.

Remote Field Training
In the contemporary high activity business environment, obtaining and training technical staff is increasingly important. Training of new field engineers has been undertaken through remote operations centers, allowing them to be involved with ongoing jobs by learning how to operate the software, take surveys, prepare logs, and troubleshoot signal detection problems from an onshore center. The ability to deliver this training without reducing service quality or causing disruption at the rig site is important to a service company, or to any operator. When the trainee is eventually sent to the rig, he or she will be better prepared to contribute safely than has been possible in the past.

Operating Statistics
Since 2006, the support structure for integrated operations centers has grown. There are now 2 regional data centers and 9 local data centers where real-time data is received from field operations. Operating statistics at this writing show that 43007 files are monthly uploaded, there are over 2500 active wells at any given time, approximately 500 well servicing operations, and over 700 wireline logging operations supported through these data centers.
In addition, over 47 operations centers are in use to support drilling services, and over 1200 producing wells are supported in production centers.
Over 800 VSATs (very small aperture terminal) are deployed for services in the authors' company alone. The average file size uploaded to the real time data centers now tops 4.5 megabytes - double the size compared to 2001. New measurements, including borehole images, high sample rate passive microseismicity measurements, and acquisition with wired drillpipe, result in an increasing demand for connectivity capacity. A typical VSAT unit in the field now transmits approximately 10 gigabytes per month, and growth is expected to increase. In early 2007, satellite connectivity was increased by almost 20%, expanding satellite connectivity to 7 more countries.

Conclusion

Real time, remote support for oilfield operations is now becoming a common way of doing business. Many projects have been performed around the world, and the benefits to the industry are becoming increasingly documented in numerous papers.

The infrastructure demands created by these operations are high, and initial developments focused on preparation to offer repeatable, optimized tools and processes to support these demands. Since the previous report, the focus has now moved more to the development of workflow processes that utilize a remote, real time infrastructure to deliver measurable improvements to critical business processes.

In the authors' organization, many such workflows have been implemented using the real time, remote infrastructure. Notable examples are in the domain of Operations Support Centers for drilling, but other services and domains are growing rapidly. The interest by operating companies in a commercial provision of the infrastructure and associated services is evidence that integrated operations centers are likely to be an important part of the oil and gas industry in the future.

References

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[2] Robert B. Thompson and Valli Shanmugam, Aethon; Shekhar Sinha, Natalie Collins, Suhas Bodwadkar, Marc Pearcy, and Stan Herl, "Optimizing the Production System Using Real-Time Measurements: A Piece of the Digital Oilfield Puzzle", SPE 110525, presented at the 2007 SPE Annual Technical Conference and Exhibition held in Anaheim, California, U.S.A., 11–14 November 2007.