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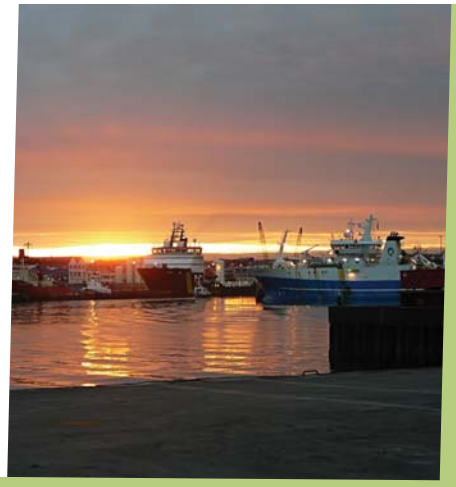
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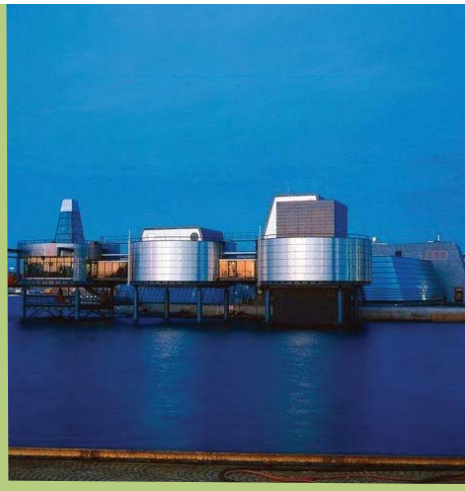
Seismic modelling through the cloud

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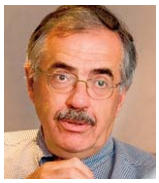
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Making small fields economic



by David Bamford

One view of mature fields is that as exploration discoveries get smaller or more complex, they become uneconomic, in some companies' minds condemning the whole region.

However, recent history shows that such an analysis is too simplistic and that provided a single operating entity can control enough resources, then the key parameter is cost/boe.

Good economics can result from such an operator's twin approach of finding more resources/reserves and reducing the costs of proving and producing them, by benefitting from scale and synergies, supply chain optimisation and so on.

Levers to find more resources / reserves might include using **exploration**, exploitation, IOR/EOR, **reservoir management**. Levers to reduce costs might include **reducing drilling costs**, digital oilfield and **reservoir management**.

Most of these 'levers' require the adroit application of technologies, more often than not digital technologies.

It is easy to argue that NW European **exploration**, in the NOCS, UKCS and onshore – is now so mature that further significant, economic discoveries should not be expected.

However, we simply do not know whether there are new plays to be tested and significant new discoveries to be made because the underpinning work has not been done.

In particular, the petroleum potential of NW Europe has not been assessed by drawing together a detailed chronostratigraphy, global geodynamics and all available public data, from wells, outcrops, publications, maps etc.

This is a "big data" problem, in principle solvable by the techniques of Gross Depositional Environment & Common Risk Segment mapping.

For **exploitation**, there has been no area-wide review of undeveloped discoveries nor of known but non-completed reservoir intervals. Here the key will be more sophisticated attribute analysis of existing mega-3D surveys, integrated with a profound understanding of rock physics.

Meanwhile **reservoir dynamics** can be far, far better understood by monitoring fluid movements with seismic, fibre optics, flow meters etc, and integrating this factual data with improved, faster, reservoir simulation honouring geomechanics. This leads both to improved recognition of reserves and therefore production, at the same time lowering costs because well locations and completions have been optimised.

In terms of **recovery**, too many companies are content with field recovery factors that settle between 30 and 40% whereas technology can take us to 60%+. A wide range of technologies are now available from 'Smart Water' via WAG to CO2-enabled EOR.

For **drilling and completions**, rig costs are the prime driver of 'oil patch' cost exponentiation, and are too controlled by a small handful of companies.

We need to promote competition in NW Europe, and promote cheaper options such as coiled tubing drilling and even cheaper options such as wireline tractors, for well intervention and completion. Technology options include sending real time drilling data to shore to improve decision making, ultimately leading to unmanned (safer, cheaper) drilling.

Finally **Integrated Operations** - DOF technologies - are the way to run fields efficiently and effectively, removing personnel from the production environment (safety), optimising production, reducing costs.

Also, to reduce costs, Regional Operating Entities (ROEs) need to control 'big swathes' of acreage, covering enough reserves to enable economic development; having 500mm to 1bn boe reserves under the control of one ROE would seem to be the right scale. This requires industry consolidation.

It is not helpful for politicians and civil servants to give 'lectures' about cooperation and collaboration – perhaps they would do better to set us all an example!

David Bamford is a non executive director of Premier Oil

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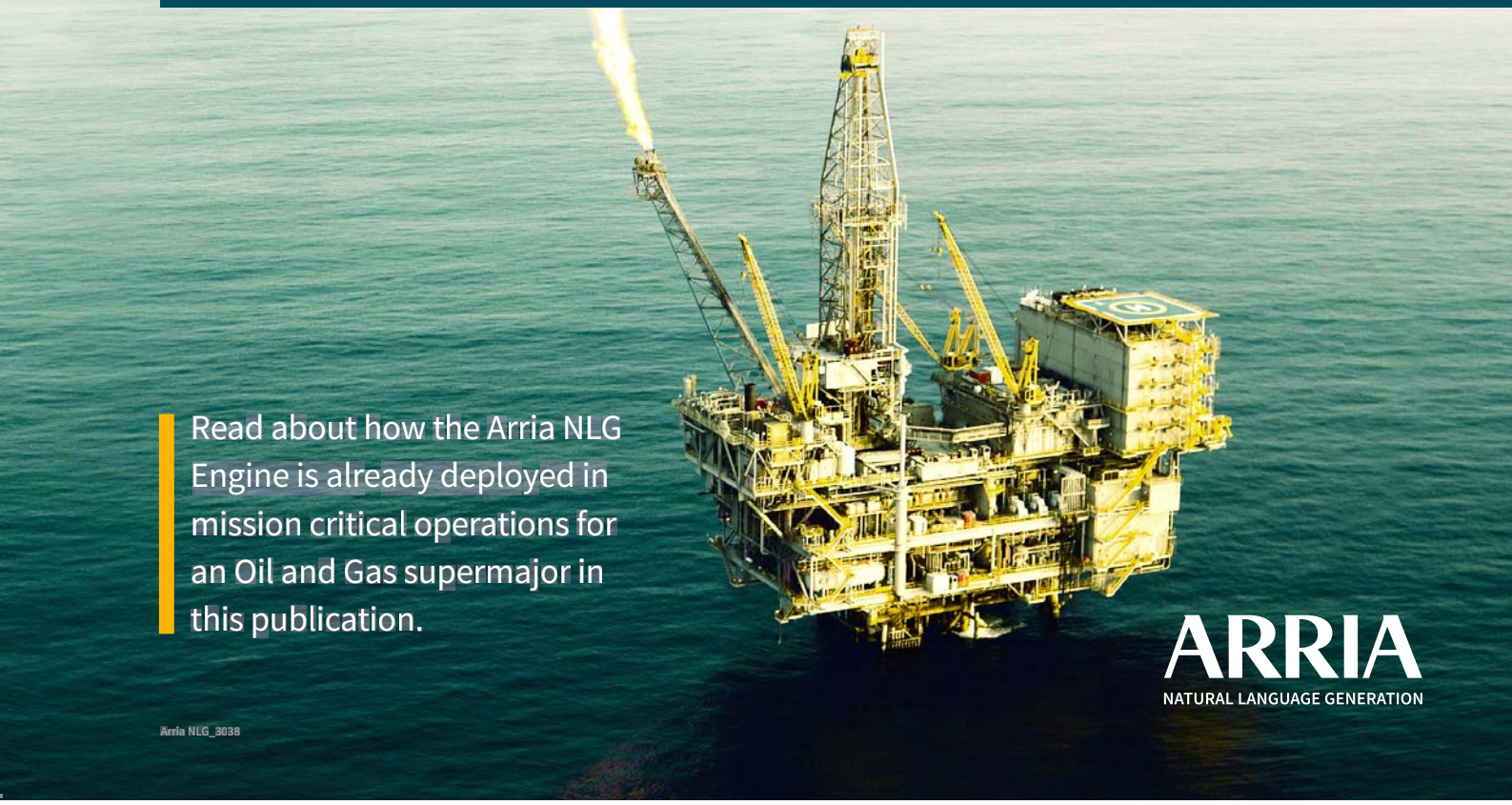
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BP: A 'top down' method to improve recovery

Trying to improve production recovery by studying flowrates and pressures could be considered a 'bottom up' method – you could also try a 'top down' method, analyzing larger amounts of data to try to identify trends, write four BP technical specialists R Bailey, Z Lu, S Shirzadi, E Ziegel of BP

The human mind, presented with a series of time data, will generally look to find common features, label these as events and seek correlations against other timelines.

This approach can be fallible, as questionable data selections might be made in attempting to find supporting evidence for a perceived pattern.

The real challenge is to establish an automated, comprehensive, dispassionate, independent and statistically valid process for pattern matching.

If all of these objectives can be met, then many evaluations could be carried out using an event-based analysis.

Instrumented systems and the analysis of their time series data can provide a range of events and channels through which those events can interact.

Some influences will be automatically transmitted by closed loop process control schemes, others will be prescribed by written operating practices, still more will be the result of 'custom and practice' on the part of operators, supervisors and planners.

Despite the presence of these systematic, non-reservoir derived reasons for patterns of change, the historical daily production data is actually the most direct measurement of the hydrocarbon fluids being extracted from the reservoir.

The business case to pursue increases in efficiency of extraction and total recovery, whilst simultaneously being able to accurately assess the effectiveness of measures taken to support, sustain and ultimately maximise that production, is clear.

"Top Down" analysis of well data

Understanding the flow from each well as a result of an agreed allocation process, based on the assessment of flow data from the well's tests, allows history matching.

Typically one or more reservoir simulation models are tuned to the observed flow and pressure data.

These processes comprise a 'bottom-up' approach to understanding the performance of the reservoir. They enable a development plan to be monitored and updated as necessary.

However, BP has been working on a separate but entirely complementary 'top-down' approach where operational data is analysed without any preconceptions about reservoir structure.

This approach allows the rapid formulation of a workable model, thus avoiding the need for an involved history-matching procedure.

The 'top-down' approach uses the Capacitance Resistivity Model combined with an analysis of the operational time-series data based on 'Events' in that data.

Event-based approach

For an asset that is being studied, one must first choose the producer and injector wells to include in the study.

These will be sufficiently well instrumented to provide a time series data stream containing events which are distinguishable from the unavoidable sources of measurement noise.

The wells will be material to the oil recovery plan and will include some key injectors as well as production wells whose output might be enhanced by the injectors.

Next, one will choose a time period for analysis.

Recent data is more likely to be most instructive in terms of potentially assessing what is likely to happen next, but better quality periods of data may exist.

Quality may be measured in terms of working instrumentation, constant or stable numbers of injection and production wells in service, and the absence of changes in operating regime, such as artificial lift or the breakthrough of water or gas into production wells.

Then, one must choose the well attribute which will be used as the variable to indicate the occurrence of an event.

Typically, the choice will be an allocated (or possibly measured) flow, an aspect of production such as water cut or gas oil ratio, or a direct intensive measurement such as a pressure or a temperature.

Similarly injector wells will have some (typically) corresponding attribute, such as injection rate or pressure.

The event-based analysis begins with the marking of events for each producer and injector well.

Parameters are used to control the relative occurrence of events. Some iteration is typically required until a set of events that make sense organically and pass visual assessments has been achieved.

Visualisations made using the association software assist with events evaluation.

Once a complete set of events has been obtained, the process associates these with each other.

This is done by considering an appropriate range of time delays that reflect the physical separation of the wells and the intervening reservoir properties.

The result is a ranking of the connections considered possible between injectors and producers together with their estimated time delays, summarized as an optimal score for each connection.

The engineer can utilise the validated scores and the resulting insights to modify other predictive reservoir models to better address the underlying business drivers around reservoir management, such as water flood pattern optimisation.

The ability to quantify production support by injectors is a key enabler for optimizing water-flood.

Practical experience

An initial BP top-down project had considered which types of modelling techniques might be able to make sense of reservoir

production surveillance data without recourse to 'bottom-up', physics-based modelling.

Four vendors, each using different methodologies, evaluated the initial three years' operational data from a complex, multi-faulted reservoir.

Complicating the analysis were changes in the number and type of wells as a transition was made from the initial pure depletion phase to an early water flood. Gas lift began to be used on some of the producer wells.

The 'event based' analysis was deemed to be the best technology. EDA (Event Detection and Association workflow) was simple to implement and sufficiently flexible, and its focus could be easily adjusted to different wells, well pairings, types of events and time periods.

It was also possible to analyse different regimes and epochs or simply constrain the period of interest to subsets of wells of interest.

The next deployment of EDA was for an offshore reservoir supported by a single gas injection well.

However, this well was operated in a 'campaign' mode, where gas was sold to market during periods of high spot price and injected into a gas cap for the rest of the year. This annual pattern of cyclic behaviour had continued for several years.

The reservoir management team wanted to review the data to decide whether to continue or alter this operational paradigm.

Event analysis was appropriate, since the operational history contained very large, unambiguous, input disturbance events, and a change in operating strategy was recommended.

This change had a net positive impact on the asset's revenue stream.

The first water-flood implementation carried out by BP was on a mature, complex, reservoir with limitations on the incremental water available and the ability to distribute it in a flexible manner to the in-field injection pads for optimisation of production support.

By loading the reservoir operating history into the application and periodically updating it, potential variations in the water-flood plan could be appraised.

The result was that any trial variation in the water-flood pattern could be either cut short or extended on the basis of on-going periodic analyses.

Event Detection and Association workflow can complement other types of analysis such as Capacitance Resistivity Model (CRM) technology as a key validation step in the delivery of Top-Down Water-flood (TDWF) assessment.

Working from the same operational data, but using it in distinctly different ways, the CRM model derives its well performance parameters using non-linear estimation.

Then EDA, focusing on the events revealed in the transient perturbations of the wells, independently checks and validates that analysis.

In TDWF deployments, the asset surveillance engineers have used the embedded, integrated EDA toolkit to validate their CRM results and support their selection of the most appropriate and statistically valid injector and producer connections.

Possible enhancements

There are challenges to the process based on well selection, chosen time period and event marking, but most of these reflect the fact that analysis is relatively simple.

However by extending the scope of the basic analysis to an attribution process for production events, typical support statistics have increased from 30 per cent to more than 80 per cent.

We also have evidence from early trials of this approach that the overall support statistics can be made to approach the theoretical limit of 100 per cent.

Genuinely complex events will involve further criteria such as 'time spent in a state', what the previous state had been, e.g. as with Markov models, and what state transitions are actually valid.

Such durations and switching behaviour, asserted from physical laws or operational rules, will provide an exponential explosion of possible system states and so provide the backdrop for the development of a genuine 'Complex Event Processing' application.

A specific class of applications that is highly suited to a bottom up, data-driven event-based analysis is the set of problems associated with product quality control, where the relationships between inputs and outputs are repeatable but complex.

If the sources of disturbances are recorded, then the application of event-based analysis could support parametric representations. Stochastic systems could be analysed. Random changes can be labelled as events but will require a slightly different workflow to compensate for the variable time delays. If causality is genuinely present, then the simple approach of utilising precedence may be sufficient to adapt the workflow to the stochastic problem. This is commonly done in econometric modelling.

Summary / next steps

This event-based technique has delivered value to several BP assets by improving the top-down representation of injection and its support to producing wells.

The technique has been automated in certain key respects. It is rapid to implement, objective, and capable of extension. It is also suitable for generalization to a range of operating data sets.

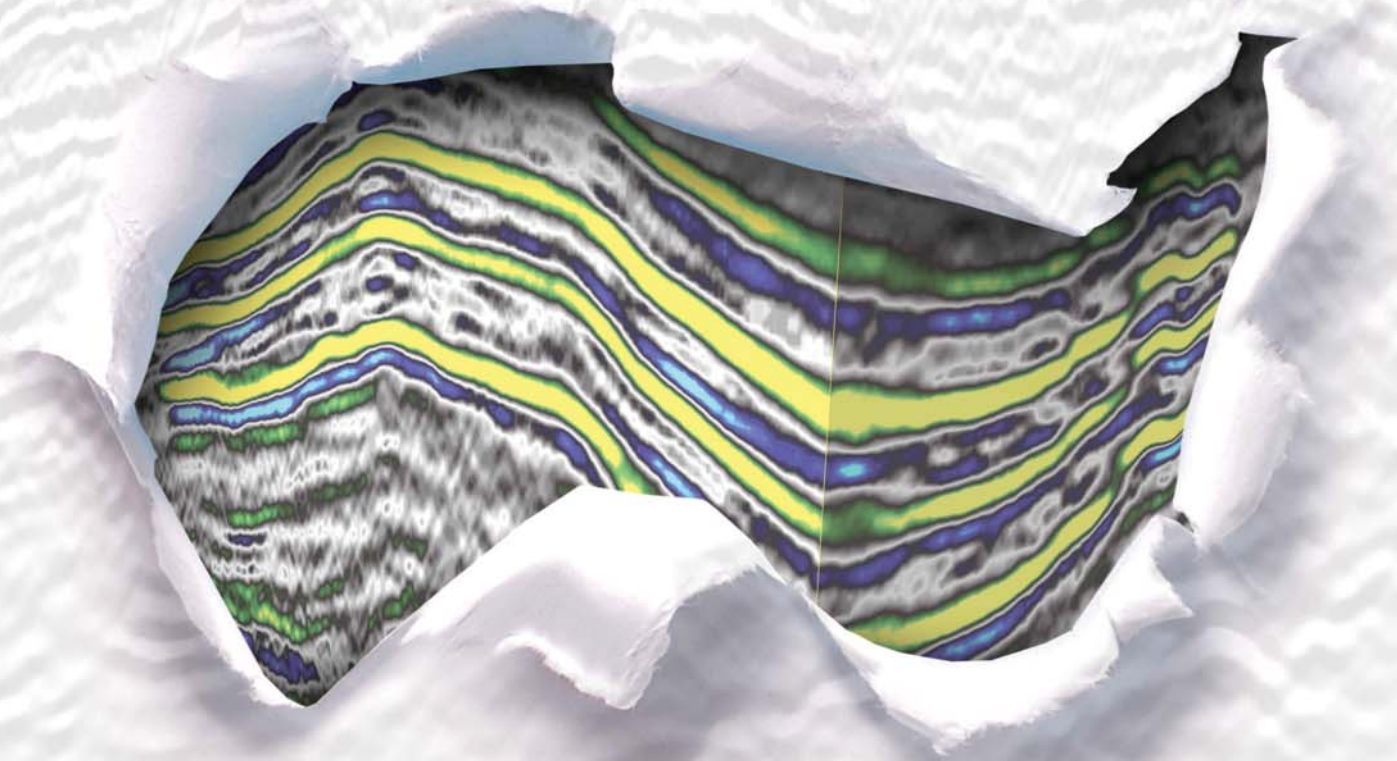
Any system of inputs and outputs that demonstrates repeatable behaviour will be amenable to event-based analysis. Systems such as TDWF which can carry out data analysis will benefit from the use of historical data to reveal additional process insights.

The next step for the development of this technology is to align it with the emergent field of 'Complex Event Processing'. This is an active field of computing with "big data" that seems likely to dominate practical oil and gas processing applications in the very near future.

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New digital technology at EAGE

New digital technology on show at the European Association of Geoscientists and Engineers (EAGE) 76th annual conference in Amsterdam (June 2014) included better tools for subsurface data, drilling analytics, and faster storage devices

Katalyst Data Management

Katalyst Data Management, of Houston, Denver, Calgary, Oklahoma City and the UK, has developed the 'iGlass' software to help you see what seismic data you have available and simultaneously makes it readily able to view it on a map. iGlass is built on PPDM 3.8 public data model, incorporating a web based ESRI GIS map interface for direct access to your digital geophysical data.

The data management tools built into iGlass encompass the full life cycle of your geophysical assets. The iGlass solution has been designed to be scalable to any level on a global basis to allow you to manage your seismic data assets consistently across geographically dispersed locations.

Proprietary data on iGlass can also be listed for license on SeismicZone, an online marketplace for proprietary seismic data. Using iGlass and SeismicZone you can see data which your company owns and data which is available for license.

At SeismicZone.com, you can search by region (country / play / state / block), search for 2D or 3D data, or search for data based on the seismic source (eg air gun, Vibroseis or dynamite) or vintage or fold.

SeismicZone provides you an opportunity to sample the quality of the data. It will show you a random sampling of in-lines and cross-lines throughout the 3D survey, which will allow you to determine whether the data has the imaging and bandwidth you require at your area of interest.

Katalyst was previously known as Kelman Data Management and offers a hosted service to manage all of your seismic and subsurface data. You can ask Katalyst to load your own seismic data which will allow you to access it whenever or wherever you are via iGlass or utilizing SeismicZone, license proprietary data online.

As part of the data management service, Katalyst will do data quality control, identify missing data, read all of the tapes so you actually know what's on them and manage the storage of the data as well as provide a disaster recovery solution.

In December 2013, Katalyst acquired the Iron Mountain's UK seismic tape transcription business.

Landmark's ZetaAnalytics

Oil and gas software company Landmark (part of Halliburton) reports that it has developed ZetaAnalytics drilling analytics software, presented together with EMC at EAGE.

It is about "unlocking the value of data you hold to drive future performance," says Pom Sabharwal, technical solutions sales manager for the ESSA (Europe and Sub-Saharan Africa) region with Landmark.

Enormous amounts of data are generated during drilling and well construction and a small percentage are used after the project is complete but might contain valuable clues to help improve future drilling projects. By running advanced analytics on well-site drilling data, it becomes possible to identify poorly performing rigs and to optimise future well-operations.

Landmark's ZetaAnalytics software can process historical and real-time data simultaneously, including WITSML data feeds and historical data stored in spreadsheets. It can process data on one or many wells and has pre-loaded analytical models for typical well challenges such as kicks (where gas enters the well) and stuck pipe - so it can give you prediction about whether a kick is likely to occur or the pipe is about to get stuck. The suite of tools has advanced domain-specific algorithms that can capture knowledge being generated in day-to-day drilling operations to drive key drilling inputs, including (ROP) rate of penetration and (WOB) weight-on-bit.

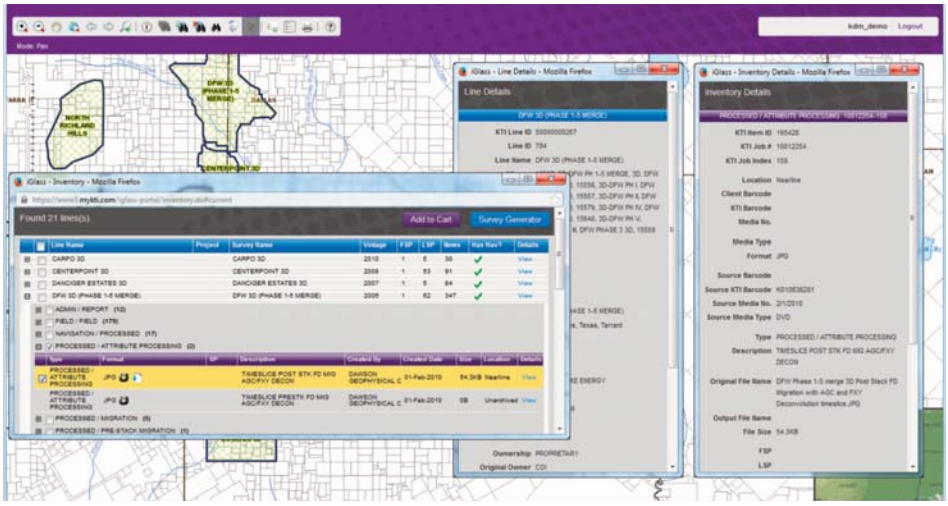
Engineers can build different and customised 'dashboards' depending on what they want to see and the consumer from management down to drilling engineers. In the future the system might be extended to include data to mobile devices. The software can run on the rig site or in headquarters.

"You can start building a knowledge base from all your wells drilled," Mr. Sabharwal says. "You can ask, what can I learn from what I've done in the past?"

ZetaAnalytics software is agnostic and works with all data warehouse products and solutions. The solution presented here works on EMC's Massively Parallel Processing (MPP) Pivotal database, which is five times faster than other data warehouse offerings, says Rick Muhleman, global alliance manager, EMC. "Analytics could be the next big thing in E&P, as big as horizontal drilling," says Mr Muhleman.

Landmark provides an analytics suite that spans across drilling to provide complete Describe-Diagnose-Predict-Prescribe capabilities. By using DecisionSpace Drilling Analytics, DecisionSpace Real Time Predictive Analytics or ZetaAnalytics operators may choose to restrict their usage of the real-time data to only a few of the workflows described in the article above.

Pivotal is an "analytics platform company"



Use Katalyst Data Management's iGlass software to see what seismic data you have, and the seismic lines, on a web based map



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based in San Francisco, which is a joint venture of EMC Corporation and VMWare (VMWare is 85 percent owned by EMC, with 15 percent traded on the stock market). In April 2013, GE spent $105 million buying a share of Pivotal. Landmark provides the software and algorithms, and EMC provides the infrastructure and database.

Panasas

Computer storage company Panasas, based in Sunnyvale, California, reports that the oil and gas market is currently one of its strongest markets, supplying storage systems to over 50 countries including Houston, Norway, UK, Russia, China, Angola, Papua New Guinea and for use onboard ships. The systems are often used for seismic processing, reservoir monitoring and interpretation.

The company manufactures the ActiveStor hybrid scale-out NAS appliance which contains a combination of solid state drives and hard disk drives filled with helium, offering higher density while drawing less power.

It makes 'blade' storage units which can hold 12.2 terabytes each, and makes 4U rack enclosures with 10 of these blades in a row, plus a 'director blade' to control them, giving you 122 terabytes of storage.

The list price for the 122 terabytes of storage is $160,000, he says.

Oil and gas companies today typically might be looking for more than 1 petabyte of storage



Panasas - 122 terabytes of storage in 4 rack units

in their headquarters (1 petabyte = 1000 terabytes = 1m gigabytes). It might have one or more "shelves" of storage (122 terabytes each) in its operating offices or on exploration ships.

The system is fully redundant, so if one blade has a problem, all you need to do is remove it and put a new one in, and the system takes care of everything else, says Geoffrey Noer, Sr. Director of Product Marketing at Panasas.

Seismic modelling through the cloud

Hue, Calgary Scientific, Lenovo, NVIDIA and Magma have teamed up to combine hardware and software offerings that deliver high-performance interactive, visual energy exploration data from the cloud.

Five companies – Hue, Calgary Scientific, Lenovo, NVIDIA and Magma – have developed a solution architecture to enable an oil company's geoscientists to perform graphics and processing-intensive tasks on their desktop computers (or laptops or even tablets), with all of the data storage and real-time processing actually carried out many miles away in a private cloud.

This can include processing raw seismic data, and then interpreting and modelling it, and running simulations.

It is common practice to use visualization to operate a regular workstation remotely on mobile devices, but until recently the quality and performance of the visualization has been limited by the capabilities of these devices.

The initiative from Hue, Calgary Scientific, Magma, NVIDIA and Lenovo solves this problem: providing a user experience tailored to a tablet or browser, which effectively has 70+ teraflops of visualization and compute capacity backing that experience.

So, instead of constraining the geoscientist by providing inadequate tools, the combined solution supports challenging scenarios related to interactivity, scalability and data management and performance.

With the joint solution, a software company could enable geoscientists to access cloud-enabled applications on mobile phones or tablet computers, while they are in the airport or elsewhere, with the performance and quality of a dedicated workstation.

Hue does not offer end user software itself, but develops a software development platform, utilizing NVIDIA's visual computing and parallel processing technologies that enable other companies to rapidly build powerful E&P applications to reveal hidden reserves behind complex geologic structures.

Among Hue's clients are the world's largest oilfield services providers, international oil companies, and leading-edge software companies.

Calgary Scientific has a system to enable people to work on any software system remotely, on any device that has a web browser, and only requiring a web link (which could be sent by e-mail) in order to get started. The software does not 'screenscrape' (scrape a video image from one screen and send it to a remote device), it interacts directly with the software code.

Lenovo and Magma build the high performance computer that runs the software in the remote data centre, with 70 teraflops of computing power (70 trillion floating point calculations per second).

NVIDIA supplies the graphics processing units (GPUs) and the CUDA parallel computing platform, which deliver the high-performance processing environment that enables the seismic data to be processed. Tesla GPUs also process the raw seismic data (in addition to the visualization provided by Quadro/GRID GPUs).

Altogether the five companies provide a joint solution for software companies (or oil and gas companies) to develop new E&P software that does not need any high-performance computers or data stored in the geoscientist's office at all.

The companies assembled the system because they believed that the oil and gas industry needs better technologies to work with large seismic data volumes and manage the underlying data, and a lot of work takes longer than it should do, due to the underperformance of previous-generation computer technology.

If you have a system where geologists are sending requests to a data centre and waiting a day for a response, or sending requests for new seismic which takes a day to receive, it is equivalent to having to do research in a local library which you are only allowed to visit once a day, says Jim Medeiros, strategic business development manager with Magma.

It is well documented that geoscientists often struggle to get the data they need on time, and their bosses often bring the deadlines for finishing work forward. Seismic data volumes are getting bigger and interpretation is getting more complicated. So any system which makes it easier to work on subsurface data, with less data communication required, should be a big help to the industry.

Hue

Hue develops unique and tailored software and services to solve the most complex visualization and compute challenges for oil and gas E&P.

Hue has developed HueSpace, the only software development toolkit created exclusively for E&P that combines exceptional data management, advanced compute capabilities, and state-of-the-art visualization into a single, easy-to-use toolkit, unified by a Core Engine.

By working with Hue, oil companies can develop both in-house and commercial solutions that go far beyond what the market and users currently expect.

Michele Isernia, EVP strategy and alliances with Hue, notes that most oil and gas software has a basis which is over 15 years old, and was built to run on a single processor, handling a limited amount of data.

The Hue platform, by contrast, was originally designed to run on massively parallel processing systems, with multiple CPU and GPU processors.

Hue is headquartered in Oslo, Norway, with offices in Houston, TX.

Calgary Scientific

Calgary Scientific provides the software visualisation and transmission part of the offering.

Calgary Scientific makes the "PureWeb" tool which enables remote access to visually intensive software applications. The company has a heritage in the medical / healthcare sector.

If the software (for working with big data volumes) is written in C++, .Net or Java under Windows or Linux, Calgary Scientific's tool is able to transfer the 'visualisation layer' (ie the display) to a remote computer without rewriting any of the code.

One user can invite a second user, or even a whole team, to see what they can see, by e-mailing them a web browser link. So both users are sharing the same software login license.

No data is stored on the mobile device and no special software is required. The data arrives at the user's computer in HTML5 or Adobe Flash.

"We integrate lightly with the source code, we don't screenscape, and turn it into web services," says Gary Mendel, VP Global Sales and Business Development with Calgary Scientific.
There is a good demonstration of the software online at http://youtu.be/wnnodCiUVhU

Lenovo + Magma + NVIDIA

The high performance computing part of the offering, running in the computing centre, is provided by Lenovo and Magma.

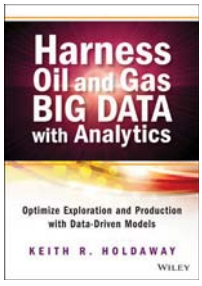
Lenovo provides the "ThinkStation D30" workstation, which the company claims is the "highest performing, most reliable and most user-friendly workstation technology available." The workstation is powered by an NVIDIA Quadro K6000 graphics card to generate the real-time visualizations of the seismic data.

Together, with Magma's ExpressBox 3600, which contains up to eight NVIDIA Tesla K40 GPU accelerators to process the seismic data, the solution provides the high performance hardware core that Hue's software solution takes maximum advantage of. Magma's Expressbox 3600 provides the power, cooling and high performance PCIe 3.0 links to keep the GPUs fed with data as needed for near real time analysis. Additionally, Lenovo enabled its BIOS to be able to initialize all eight NVIDIA Tesla K40 GPU accelerators, making it one of the most expandable platforms on the market.

NVIDIA's GRID K2 GPUs and virtualization technology housed at Amazon Web Services are also used to deliver high-performance, high-resolution seismic visualizations in real-time to laptops, tablets and other mobile devices remotely in the field.

The Hue technology is already optimised to work using the Lenovo / Magma / NVIDIA system.

New book on oil and gas analytics





Keith Holdaway, principal industry consultant with SAS (and a former senior geophysicist with Shell), has published a substantial book on harnessing oil and gas big data with analytics (Wiley, July 2014).

The book explains how various "big data analytics" techniques can be used to help improve production, including how to do statistical and qualitative analysis, predictive modelling, to help make better decisions. Particular areas of coverage include data management, quantifying uncertainty and risk assessment.

You can get an in-depth understanding of what "Soft Computing" actually means (use of inexact solutions, in short).

There is in-depth coverage of seismic attribute analytics, reservoir characterisation, drilling and completion optimisation (including a workflow for mitigating non-productive time), reservoir management, production forecasting (including predicting production from an infill well), optimising production, predicting the value of exploration and production projects, data visualisation, working with 'big data', geostatistics.

The book takes the idea of analytics work to a new level. Many people (including your correspondent, until he read this book) believe that there is a binary debate about letting experts (who understand the engineering systems) work with data, or getting automated systems to try to spot patterns in it.

But the real answer is that you need both experts in engineering systems and the data analysis – but with it you could find some answers which could make a big difference to the industry.

This is a substantial book – but worth the effort of trying to get through, if you would like a better understanding of how analytics can be used to improve the way the upstream oil and gas industry works.

Ayasdi's "Topological Data Analysis" for finding oil

Californian company Ayasdi has developed a "Topological Data Analysis" approach to big data, which is being used by Anardarko Petroleum and Baker Hughes, among others in the oil and gas industry

Aysadi, a company based in Menlo Park, California, has developed a 'Topological Data Analysis' approach to big data in the oil and gas industry – which essentially means looking for shapes in the data.

It is being used by a number of (undisclosed) large oil and gas companies.

The technology was originally developed at the US Defense Advanced Research Projects Agency (DARPA), and has been described by Tony Tether, a past director of DARPA, as "one of the top 10 innovations developed at DARPA in the last decade."

Ayasdi helps clients get value from their big data sets by identifying statistically significant patterns or shapes in it.

The standard way to work with large data sets is to try to find answers to specific questions, for example how much does a certain setting affect production, or is a component likely to fail when this temperature reading rises above a certain amount.

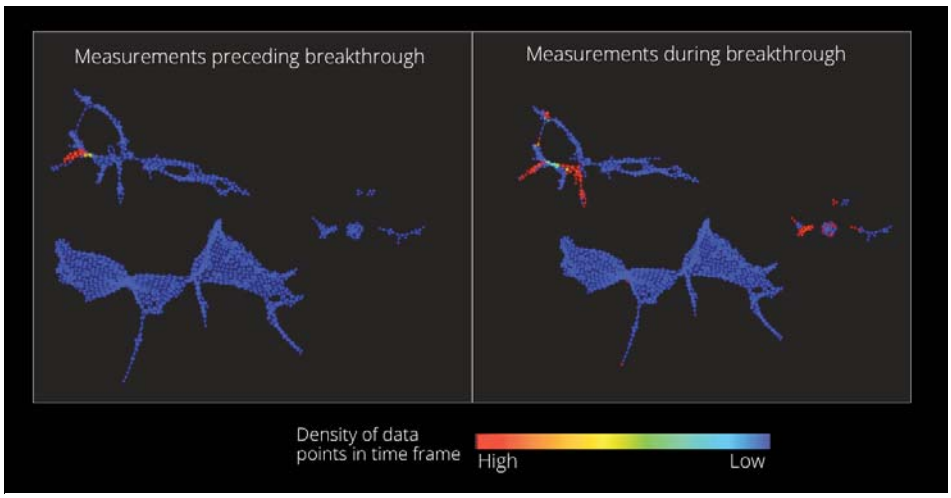
The limit to this approach is that there are so many possible questions you could ask, and you probably don't have time to ask them all, Ayasdi says.

So instead, you can use the computer to try to work out patterns, and then the human expert comes in afterwards to say whether or not this could be useful information. This way, the computer can spot useful patterns or signals that might otherwise be missed.

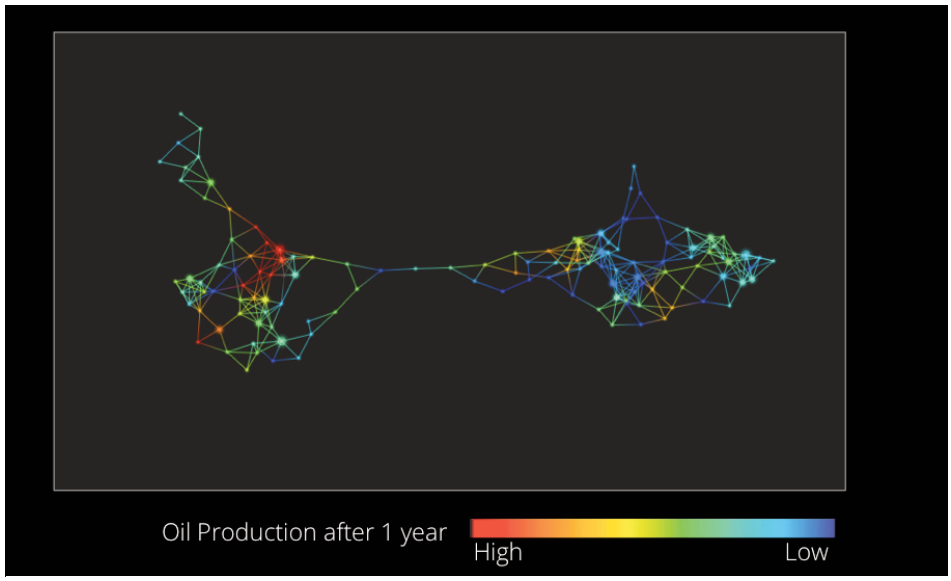
For example, a "topological" analysis of well production might show that all of the wells in one region are producing more than wells in another region, which is probably something you knew already.

But the same analysis might also point out that a smaller cluster of wells in the non performing region are performing better than average for that part of the field, and it might also tell you that these wells are completed in a different way. This could be very useful business information.

A topological analysis could study data about steam stimulation in parallel wells, to help you get earlier warning that a "breakthrough" is about to occur, where the steam goes directly from the injection well to the production well, without achieving anything useful on the way.



The pattern of data preceding a breakthrough of steam in a SAGD well - and the pattern of data during a breakthrough. Can you use this to predict when a breakthrough is about to happen?



Using shapes to get a better understanding of oil production from different wells – this chart shows oil production correlated against various geologic properties of the subsurface around each well

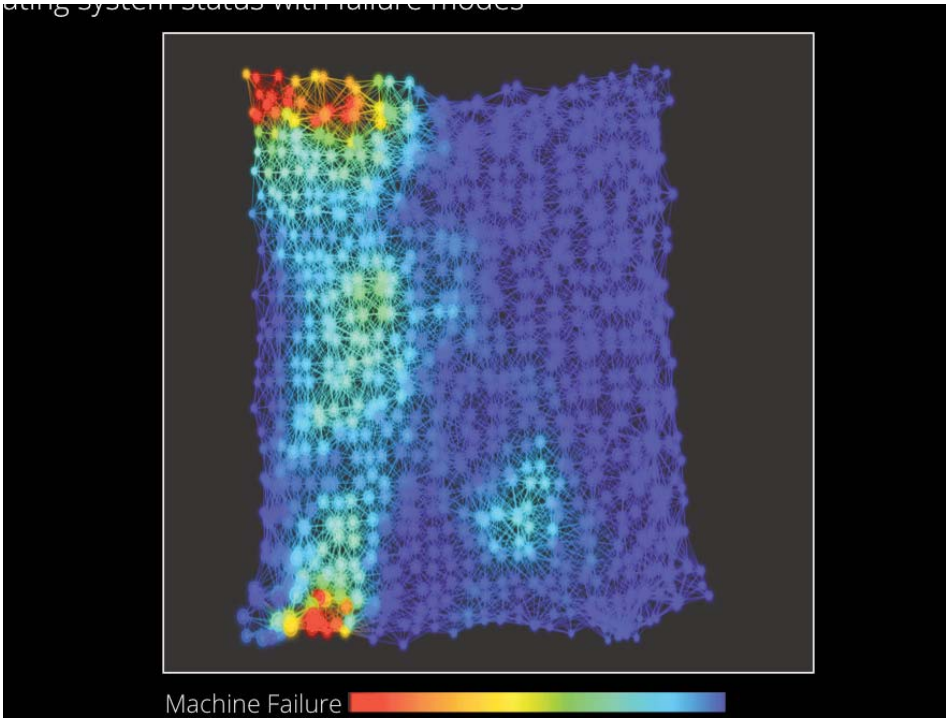
You can try to find data patterns which precede a breakthrough event, which are not present in normal operations. If a petroleum engineer agrees that the pattern makes sense, you can train the computer to look for the same patterns due to normal operations, and get much earlier warning that a breakthrough is about to occur.

You can do topological analysis of data from complex machinery, which might show that a certain attribute (for example, temperature of a piece of equipment) becomes either very low, or very high, just before a certain component fails.

This way, you can also avoid working with the wrong attributes. "If you are doing maintenance every time a certain attribute gets above a certain flag level, you could be doing a lot of unnecessary work," says Alexis Johnson, senior solution analyst with Ayasdi.

The approach can be used with words as well as data – for example trying to spot patterns in word usage in documents, books, and Twitter feeds, and try to spot similarities in the documents.

Altogether, the most likely areas for the process to add value in oil and gas seem to



We know when machinery has failed (shown in red) – it would be very helpful to know when machinery is close to failing (shown in light blue)

be in exploration, optimising and understanding drilling processes, and in logistics, Ms Johnson says.

Anadarko

Anadarko Petroleum worked with Ayasdi to get a better understanding of subsurface geological, geophysical, petrophysical and engineering production data.

Using the technology, "we can optimise development planning for unconventional shale and deepwater assets in North America and around the world," said PK Pande, director of reservoir technology and reservoir characterisation with Anadarko.

In another oil and gas industry example, Ayasdi was involved in trying to work out how to improve production from an oil field. All the wells in the oilfield had sensors measuring properties like pressure and flowrate, with regular measurements.

Using Ayasdi, the customer was able to cluster wells based on their behaviour and was able to detect patterns in production levels.

Other customers

Citi (the bank) is using Ayasdi to automate the 'data to value process', genetics company Mt Sinai is using it to help with research to identify genetic predispositions of many diseases including cancer.

Pharmaceutical company Merck is working with Ayasdi to analyse datasets for drug discovery.

The University of California San Francisco is working with Ayasdi to identify patients most likely to benefit from traumatic brain injury treatment.

digital energy journal

Managing project costs - by keeping on top of data

We have all heard that the oil and gas industry often sees costs escalate on major projects - the answer could be better tools to keep track of the reasons costs rise, writes 8over8's Clare Colhoun

The largest capital projects are increasingly complex and unpredictable. Projects have more stakeholders, more investors, and are typically in frontier areas of the world with national government involvement.



The better you can manage changes to contracts, the better you can keep overall project costs under control - Clare Colhoun, CEO, 8over8

The result is major projects today that are fraught with risk and change, due to significant growth in communications traffic laden with instructions, authorisations and vital content for decision-making. Even the best design team that produces the front-end engineering design (FEED) would never foresee and conceive of 100 per cent of what is required to deliver the project, so contractors will always instigate change orders.

The change orders and variation requests made in communications from contractors take time to filter through to the financial teams and treasuries of owner operators. These can fester and grow to significant levels overtime, and ultimately result in costly claims later on in projects, when it is harder to establish the origin and validity of the changes.

The industry's record of managing cost overruns has something to be desired. For example, Schlumberger reports that 35 per cent of capital projects budgeted at over $5bn will blow out by more than 50 per cent.

The average project size in the oil and gas industry currently stands at about $1.9bn and continues to rise as more 'super-sized' mega projects come online. There are also several oil and gas projects valued at over $30bn that have suffered significant delays and cost overruns, an example being the $50bn Kashagan oilfield development in Kazakhstan, which is estimated to hit $1.5bn in cost overruns.

Unplanned cost overruns and poor cost recovery not only impact directly on the owner operator's financial performance, they place shareholder value at risk.

Interdependencies

With large capital projects in the oil and gas sector increasingly characterised by several venture partners sharing both risk and return, the contracts that underpin them have many interdependencies.

Clear rules of engagement must be defined in advance, both amongst the venture partners and between the venture and its contractors.

Successful contract execution in ground-

breaking floating LNG (FLNG) projects, such as Shell's Prelude for example, involves developing a suite of project contracts across the FLNG value chain that creates an effective alignment of interests among each of the relevant project parties, whilst eliminating or mitigating risk.

Open channels

Many interdependencies also mean many open channels of communication. These channels are absolutely critical, but are risk laden in that they can drive unnecessary change into the project.

The inherent risk only becomes manifest when the owner operator looks to cost-recover a percentage from a joint venture partner, but discovers that the communications surrounding the change are untraceable.

So instructions and the thread of communications that trigger a contractual change must be recorded meticulously.

Contractual risk management entails de-risking the commercial engagement by ensuring that the chaotic communications that exist on a large capital project are streamlined and controlled, whether they are a communication about an instruction, an obligation, potential change, or site query.

Making communications structured

Imagine that time is a constant represented by a horizontal axis. Capital is deployed in increasingly larger amounts as construction of the project progresses over time.

That capital is deployed via contracts, but without a system of engagement to provide a disciplined way of managing the risk inherent within those contracts, the entire process is left open to change due to unnecessary, unstructured and cluttered communications channels.

This occurs both internally with the owner operator and its partners, and externally with contractors.

Now imagine the application of contractual risk management as being like a coil that wraps around the project timeline. The 'coil' is a system of record. When it's switched on, it aggregates all communications across the project timeline. Here, unstructured communications become structured under specific categories.

Crucially, the timeline and the coil are intertwined, much like a DNA sequence, to provide an indisputable record of all formal contract data, communications, contractual obligations, review decisions and decision response times.

By being able to retrieve, as required, auditable and irrefutable evidence held within a 'DNA sequence', owner operators are able to reduce instances of claims and maximise cost recovery to ensure all project and contract stakeholders bear their appropriate share of legitimate unplanned costs.

Using analytics

Applying analytics to a combined system of engagement and system of record, where disciplined and structured communications are stored within a single platform, owner operators can start to act on the business intelligence available.

For example, if a variation order request on a major project is received from a contractor and has a significant value associated with it, that communication can be routed to those that need to see it and, more importantly, to those that need to take the decision on whether or not to approve it.

A further benefit is that owner operators can measure the riskiness of a particular project. Should a large volume of variation order requests come in over a short period of time, they can be escalated to appropriate stakeholders to notify them that scope is a problem and as such the project is at risk of blowing out.

Action can then be taken to avert significant value leakage and scheduling overruns in commercial relationships with contractors, which current in-house systems are simply unable to achieve.

Single platform

Instructing contractors, partners and stakeholders to use a single formal commercial platform (software system) for communicating with owner operators whilst executing contracts and to adopt the oil company standards is a must.

All instructions and communications to and from the contractor and owner operator teams flow through this one channel in a pre-defined, organised way.

It connects the engineering world with the commercial world by insisting all technical queries, instructions and otherwise are routed through the commercial channel for review, checking alignment or disparity with the contract, and then to the contractor and owner operator's technical teams.

You can gain significant insights by analysing the commercial communication traffic that highlights priority areas of the engagement that need attention.

This is a new 'early warning' focus on potential change requests. It allows owner operators to accept necessary changes, but importantly, allows them to avoid unnecessary changes that can blindside a project when they fester to significant levels and result in claims.

Examples

One international oil company (IOC) that implemented a contractual risk management solution to drive capital discipline across 25 projects reduced its actual outcome versus final investment decision cost target by some 65 per cent from a previous period. Another firm, a lead operator, recovered over $1.7bn from partners on a major capital development programme in Africa.

Meanwhile, an oil major managing a $12bn mega project recently completed the development with zero successful claims from contractors. In other words, not a single dispute or unapproved variation was accepted. Such a recovery was previously unheard of in the oil and gas industry.

One oil and gas independent has even deployed a contractual risk management solution based on the business case of recovering $1m per day in enhanced cost recovery.

Ultimately, by managing key contractual risks, owner operators benefit from connected decision-making through improved capital discipline, and therefore realise a much more predictable commercial outcome.

Clare Colhoun is CEO of 8over8, a rapidly growing company with offices in Europe, North America, Australia and the Middle East.

Head-quartered in the United Kingdom, 8over8 provides contractual risk management solutions to owner operators of large capital projects in the oil & gas, mining, infrastructure and the evolving smart infrastructure development sectors.
www.8over8.com



SIEMENS

TOTAL E&P using COMOS Walkinside for Safety Training and Profit

Would you like to read the case study "TOTAL E&P" please visit www.siemens.dk/comos/references

Captain Chesley B. "Sully" Sullenberger took command moments after the ill-fated USAir flight 1549 took off fromLaGuardia Airport in New York, he had never had an incident that called for him conduct a controlled crash landing before, but after hours upon hours of immersive flight simulator training, he was confident he could successfully do the job.

While surely his heart was racing, he exhibited the demeanor of a cool cat under the intense pressure of a landing in the Hudson River where one slight mistake could cost the lives of over 150 people on board.

Now take that case and apply it to an offshore installation where an operator doing his rounds on a massive floating production, storage and offloading (FPSO) unit anchored off the coast of Angola, Africa, comes upon a visible gas leak and also a man down. That is a potential crisis in the making and the operator must make the right decision immediately. Save the fellow worker or ensure the safety of other workers and the FPSO? Training gives the proper response.

That is why French oil and gas giant, TOTAL, is focusing its operators on its Immersive Training Simulator (ITS).

ITS is an accurate 3D immersive environment where a worker can visualize what tasks he should perform and rehearse and look at ways to conduct certain workflows that involve any number of scenarios.

"We have to have training that reaches everybody," said Nicolas Tarisse, field operations training manager at TOTAL E&P.

TOTAL does have different types of training for workers, but ITS puts workers in a true 3D virtual environment that effectively teaches them what to do and when to do it.

Training operators to get up and running quickly and efficiently is one thing, but an end goal is to get personnel as productive as quickly as possible to maximize profitability.

In TOTAL's case, the oil and gas giant used the COMOS Walkinside Immersive Training Simulator and it really did simulate real-life scenarios. The 3D model can show details of the existing plant which allows operators to become familiar with the surroundings before stepping foot in the physical property. That allows for quicker and more productive operations. The 3D objects can add into the virtual reality model to show evacuation routes, emergency and firefighting equipment signs. Sound effects also complete the realistic setting.

Some of the benefits COMOS Walkinside ITS allows:

- Improved personal safety through virtual training in the life-like virtual environment
- Immersive training experience with easy, fast and game-like navigation
- Efficient training of cooperation and interaction between teams
- Counteracts the increasing shortage in experienced personnel
- High value for dangerous and remote working environments
- Training can start before the real plant is operating

www.siemens.com/comos

New technology - 'come back in 3 years'

When engineers ask Robert Faulds, project director of Total UK's Laggan Tormore project, to implement technology, "they tend to not be very pleased when I tell them, come back in 3 years and I'll think about it"

Robert Faulds, project director of Total UK's Laggan Tormore project, believes that new technology can be very valuable in complex projects, "but not every 5 minutes."



"Do not use new technology unless you've got absolutely no choice" - Robert Faulds, project director of Total UK's Laggan Tormore project (photograph taken from video)

"Engineers are bred and designed to come up with new ideas. Even today, I've got a stream of engineers come to my office with new ideas. They tend to not be very pleased when I tell them come back in 3 years and I'll think about it," he said.

He was speaking at the Oil and Gas UK London Breakfast Briefing on May 21 2014, "Planning for success: Managing complex projects" (see end of article).

"Lots of people talk about standardisation," he said. "I think it's great, it does drive down cost, cut and paste and all the rest of it, fantastic.

"In my view, standardise, do what you know you do well."

"You need to find a way to get your technical [experts] in the company to agree to that, not very easy."

[but] "Do not use new technology unless you've got absolutely no choice, and if you do use new technology, make sure you fully understand it, you understand all the risk you're taking. And make sure it adds value."

"Sometimes new technology is unavoidable. Maybe the only way to render your project economic. But it does bring additional risk."

"If you're buying new technology for the sake of new technology, [well] we're not in the research business we're in the project business."

Big drop in UKCS

Due to a growth in project costs, the UK Continental Shelf is likely to see a big drop in investment over the next 3-4 years, he said.

"I read a recent note which said that in 2013 the UK's investment peak was something like £14bn, they reckon by 2017 - 2018 it would get to £7bn," he said.

"Personally I think you're going to be lucky to get 2 [billion pounds in 2017-2018], especially if the costs don't correct."

"My personal view is we've experienced a boom and the bust is going to come."

"I personally think we're heading towards another fall in the oil and gas UK, I think the oil industry in the UK is about to go through an extremely lean time. I think that a lot of yards will close a lot of people will move overseas."

"Why? Wood Mckenzie figures from May 2014 - 74 per cent of projects in the UK and Norway are over budget. Average overspend is 18 percent."

"Why? Prices are going up all the time."

"We recently finished a tender for a project called Edradour, going for its final investment decisions. It cost nearly three times what it would have cost in 2010."

"Industry capacity to deliver these projects is not keeping pace, and that's leading to overspend and delay."

"For me the question is, we've had the boom in the UK, when the bust will arrive, not if it will arrive. Is it 6 months, 12 months, is it 18 months. It ain't 2 years."

"In 6 days time, I am going to be bidding to try to make sure I secure part of my company's investment budget for this year to do a project.

"It is a competition, that's what people don't get."

"Everybody says, "It's oil and gas". [but] if you've got £10bn to invest 2015 or 2014, the company is going to put that money where it gets the best return on its investment."

"I think that the IOCs with this [UK] trend [of] increased cost, smaller field size, are going to invest their money elsewhere."

"The market doesn't show any sense of slowing down internationally, that means the money we have as IOCs are more likely to be going overseas with higher returns."

"Future major projects in the UK are being revisited today. It is already here, it is starting to happen now."

Super contractors

"The international oil companies have created their own nightmare. We've allowed and encouraged the creation of giant super contractors," he said.

"I think now the tail has been wagging the cost and schedule dog. They don't even talk to me as if I'm the client any more apart from when I refuse to sign their invoice."

"This is not new. I looked at papers from 1990 [about] the CRINE initiative, basically they could have been written yesterday. It hasn't changed. We need to find a way to work with our contractors."

"Any every contractor is different. Every contractor has got its own risk profile and values its risk independently."

"Whatever we do, I don't actually believe in industry initiatives. I've seen too many of them. CRINE, we've had other ones."

"Frankly they've never worked. The only thing they've done is make consultants richer."

"I know people who've retired on CRINE. We didn't make any money out of that."

People

"You can't do anything without people, you can't do everything yourself," he said.

"Just to give you an idea of Laggan Tormore, at our peak we had 20,000 people working on the project worldwide. I had something like 7 offices with my name on the door. I have more air miles than Richard Branson."

"In year one we had 22 per cent [staff] turnover. Why? Because lots and lots of people have got used to working in this country 9 to 4 - having a 1 hour lunch break working at a nice pace."

"Projects don't do that. We work until the job

is done. If that means we're working until 9 10 o'clock at night, weekends, public holidays, that's what we do. If people don't like it, don't join a project."

"Year two this [staff turnover] dropped to 10 per cent. We weeded out the weaker members of our team. At the end of the day the strong will survive."

"Keeping people is not easy. Why is it not easy? 80 per cent of project team in general is on a short term contract."

"Why? Because we never know when the next project is coming. Industry changes, investment profiles change, attitudes change."

"Job opportunities at the moment are seemingly limitless, and day rates every day seem to go up."

Mr Faulds quoted figures from a supplier saying that (April 2014) the cost of an engineer per day in Norway was £1400, compared to £1000 18 months ago. "And they might not even be any good," he said.

"High turnover rate of the wrong people kills your project quicker than anything else," he said.

"Finding people in the UK who are driven to deliver projects, is harder and harder. There are less young people motivated to work the extra hours."

"I hear a lot about work life balance, I think we have become too rich, it has gone too far. I've heard about 9 day fortnight, 9 to 4 working 1 hour for lunch.

Finding better people

"[the key to] getting better people is not education," he said. "We need to find a way to make people more driven, and look at different sources for people," he said.

Mr Faulds said he is particularly keen on recruiting from the military.

"I've been trying to teach engineers how to become leaders for years and largely failed, with some successes," he said. "I'm wondering if I can teach leaders to become engineers."

The British military in general is looking to reduce its numbers of non-commissioned officers (NCOs) and young officers, he said.

"So we're looking at a training program which I am sponsoring to try to get the people into our industry.

"They seem to be brilliant project execution people.

"So I think that's a real source for future talent."

View Mr Fauld's talk on video at
http://bit.ly/mcpoguk
Which directs to
www.oilandgasuk.co.uk/news/Managing_Complex_Projects.cfm

How AAF upgraded its legacy ERP system

American Air Filter (AAF), a supplier of equipment for air supply and noise abatement for gas turbines for the oil and gas industry, recently upgraded its ERP system from a 17 year old legacy system to Microsoft Dynamics, supplied by HSO Equipment of Aberdeen

The UK division of American Air Filter Ltd (AAF), a supplier of equipment for air supply and noise abatement in gas turbines for the oil and gas industry, recently decided to upgrade its 17 year old legacy software, developed in-house, to a new Microsoft Dynamics software, supplied by HSE Equipment of Aberdeen.

The software it replaced was being used for managing reporting and financial reconciliation, as well as providing critical statements at the end of each month.

AAF Ltd had, over time, developed over 100 applications to run alongside it in order to keep up with business changes.

The current solution was not designed for the size that AAF Ltd has grown to, which meant that the technology was creaking at the seams. "The availability of management information was very slow and it was hindering business performance. We also had technical issues and a heavy reliance on spreadsheets," says Nick Carr, new project manager for ERP implementation at AAF Ltd.

The lack of integration meant that AAF was limited in ways key management documents could be recorded and shared. The reliance on spreadsheets was causing not only inefficiencies in creating and sharing reporting documents, but also increasing risk of human error.

Also, a lot of the knowledge about how to use the software was held by one member of staff, who had retired, taking a lot of knowledge with him, Mr Carr says.

AAF wanted to make sure that its new system could be managed by a third party company, so it could ensure consistency and continued knowledge even if internal teams changed.

Pitch process

In deciding which software to use, AAF worked through 97 different companies and solutions, including SAP, JD Edwards, EFAX, Epicor and IFS.

Two full days of software demonstrations were held, to an AAF selection committee.

AAF selected Microsoft Dynamics AX "due to its integration functionality, ability to be implemented and maintained by a third party external vendor, and ability to service both back and front line office requirements."

It selected HSO as the vendor, due to HSO's "technical expertise around the Dynamics AX, their understanding of AAF Ltd's business and their knowledge and experience in the manufacturing and oil and gas markets," HSO says.

"Dynamics AX is a Microsoft product, and we understand Microsoft as a company have a huge development programme which means that there will be no maintenance issues going forward," says Robert Carling, General Manager and Director at AAF Ltd.

"We chose Microsoft Dynamic AX because it is a one platform solution that can integrate our entire business," says Nick Carr, project manager. "The key requirements of the new ERP solution would be to take all the bespoke modules and condense them into one single working solution."

www.hso-equipment.com

When natural language beats visualisation

Computers usually communicate data to us using complex visualisations - while we usually communicate with our colleagues using language - by speaking to them. Could computers communicate with us using language too?

By Dr Robert Dale, CTO and Chief Strategy Scientist, Arria NLG



Making computer systems which tell you what you need using natural language - Dr Robert Dale, ARRIA

But when it comes time to make use of the insights that might be gleaned from the data, and from charts and graphs that display that data, it's almost always the case that the key information will be communicated from one person to another via language.

Human language has evolved over many tens of thousands of years as a finely-honed tool for conveying information. It is, quite simply, the best means we have for communicating meaning.

It's only recently that machines have started to acquire this capability, in the form of what we might call 'articulate analytics', the automatic generation of narrative text, mixed with graphs and tables, that explains key information and provides a recommendation based on software-embodied expertise.

Our company Arria NLG has been deploying this technology in the Gulf of Mexico, where our Natural Language Generation software is used to provide exception-based surveillance.

An alarm is triggered when the data from a sensor breaches an important threshold, and this spurs the Arria NLG Engine into action. The Engine analyses all the related sensor data to detect significant events, and it incorporates historical information about previous alerts and the relevant service history.

Based on this analysis, it writes a detailed situational analysis report and provides a recommendation for action.

The software can produce such a report within 60–90 seconds of the alarm. That's in contrast to the 3–4 hours it might take a human expert to produce the same analysis and recommendation.

The technology doesn't replace human engineers, but it makes them vastly more productive. The engineer can choose to accept or refine the system's report and recommendation, in a tiny fraction of the time that would be required to create it manually from scratch.

Technology

Natural Language Generation, the underlying technology that makes this possible, is a sophisticated combination of tried-and tested techniques from data analytics, artificial intelligence and computational linguistics.

It can take a diverse set of data sources, analyse that data using processes that emulate human reasoning, and then express the results of that analysis and reasoning in natural language, including English, Spanish and Chinese.

So it takes data and turns that data into actionable plain language reports that provide timely decision support because they are easily understood.

It's a multistep process that first considers the range of data available to determine what important information it contains; then, it reasons about how best to present that information in clear and concise language to convey what's significant and why, and what should be done about it.

Human plus computer

To make this work, we capture in software the ability of the engineer to articulate both the problem and the answer that is needed to deal with the problem.

By capturing the knowledge and experience of the engineer in the software, we get easily replicable and scalable expertise that consistently produces articulate output.

Combining automated data collection with the automated knowledge and experience of your subject matter experts means that you are far less likely to miss the vital data required for making the right decisions in the field.

NLG doesn't "dumb down" data analysis, either for a non-technical audience or for experienced engineers, although it can straightforwardly produce different styles of reports for different audiences using the same input data.

Its key purpose is to make sense of the huge volume of data available, and to cut down on the time needed by engineers in the field to analyse what needs doing—and therefore increase the time and information available to them to focus on the maintenance and repairs that are needed.

It's the application of knowledge and experience, articulated in a style that an individual can understand at their own level, whether they are non-technical or an engineer with years of experience.

Oil and gas applications

In difficult-to-operate environments, for example in deepwater operations, the Arctic, or anywhere that might be considered harsh, the technology can provide operators with an option for minimum manning whilst still retaining a rapid decision-making capability.

The technology is useful in frontier exploration, particularly in the emerging nations, where data is stored in a wide range of different formats—documents, spreadsheets, CAD drawings and so on. Structured elements of these data sources can be used by NLG to produce output in articulate text with appropriately-annotated illustrations.

The technology is useful for asset integrity management. Because of the speed at which the available data can be processed and analysed, maintenance can be carried out before a situation becomes critical. The more sensors for pressure, temperature, motion and so on that a rig has, the more data there is to interpret, and the more NLG can help. Reducing the risk of error and repair in turn leads to reduced downtime, which of course means higher productivity.

Arria NLG is a company specialising in Natural Language Generation (NLG) for mission critical industries, including oil and gas, healthcare and meterology. It has offices in London, Aberdeen, New York and Auckland. See **http://www.arria.com/**

OFS Portal®

eEnable Your Supply Chain

Founded in 2000, **OFS Portal** is an organization which consists of diverse supplier members who are committed to promoting eCommerce and reducing cost. We have a non-profit objective to ensure we promote the best approaches for the industry. In addition to advocating strong protection for the security and confidentiality of electronic data, **OFS Portal** has gained the trust and confidence of the entire upstream oil and gas industry. We do this through our proactive advocacy approach toward best practices to reduce costs and complexity while increasing the speed of adoption.

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Increasing demand for subsea wireless communications

WFS reports that the use of its subsea wireless communications and control systems is being increased for applications such as asset integrity management, video and data transmission.



Developing short range high-speed wireless subsea communications for the oil and gas industry: Ian Crowther, executive vice president of WFS

WFS reports that the use of its subsea wireless communications and control systems is being increased for applications such as asset integrity management, video and data transmission.

WFS Technologies was founded in 2003 by Brendan Hyland. Much of WFS's early work in underwater radio was for defence applications, where RF (radio frequency) had been used extensively in the past for submarine communications.

Over 5 years ago, WFS identified a market in the subsea oil and gas industry for short-range high-speed wireless communications, similar to the functionality delivered by Bluetooth and wi-fi in homes, offices and industrial facilities.

WFS' initial focus of doing business was in the Gulf of Mexico but its wireless subsea technology has gradually penetrated North Sea, South East Asia, Australia and West Africa. In the last 5 years the company has delivered more than 7,000 communication and control devices around the world.

"North Sea operators are using our wireless instrumentation to monitor the integrity of subsea equipment", said Ian Crowther, executive vice president of WFS, speaking at the Digital Energy Journal forum in Aberdeen on June 2 2014, "Digital subsea - integrity management and monitoring."

"Our products include wireless video cameras to support ROV construction and intervention, wireless tools for subsea survey operations, and wireless temperature and pressure sensors for monitoring pipeline integrity", said Mr Crowther.

Subsea wireless data logging

WFS produces the "Seatooth" range of subsea wireless dataloggers and controllers that transmit data and video through water.

A new product recently added to the Seatooth family is Seatooth PPC, a wireless datalogger for pipeline pre-commissioning. Hydrotest data can be captured, stored and downloaded reliably at data rates of up to 156kbps.

Once the data is downloaded it can then be retrieved to the surface for analysis. This gives the operator permanent pre-commissioning data, indicating data about the pipeline and water temperature.

As an extension to the PPC product, WFS developed "Seatooth WiPS," an integrated subsea system that provides real-time pressure data. It comprises a high accuracy pressure sensor, a wireless datalogger and an LED display and provides pressure measurements up to 20,000 psi in depths up to 4000m. This is used for hydrotest applications measuring pipeline pressure, or survey operations providing precise depth measurements.

Radio signals are unaffected by acoustic noise or biofouling, and are free from multi-pathing problems. The signals can be sent in the presence of gas bubbles or high turbidity.

"It is critical that power consumption during datalogging is low in order to maximise the deployment duration and capture as much monitoring data as possible", Mr Crowther says.

"A number of factors help support long term deployments of wireless instrumentation systems," he said.

"Firstly, Seatooth is a very low power technology: not much power is consumed when the system is in operation; also, it has an ultra-low power sleep mode which is quite unique."

"Secondly, by transferring data at very high data rates the system is only in its operational mode for short periods of time, so it can stay in the sleep mode for longer consuming less power."

"Thirdly, Seatooth systems operate as wireless controllers, devices can be switched on/off, or reconfigured over a wireless link, and this technique can be used to extend battery life.

"Finally, the batteries are electrically disconnected, but can be turned on wirelessly, and this allows the battery life to be further extended. All of these factors, along with developments in battery technology, mean that we can deploy systems for periods of up to 10 years".

"A common way of downloading subsea data is with the use of cables and connectors which are common sources of downtime, either through failure or servicing.

By transferring data wirelessly, the risk associated by aligning pins and servicing electrical connections is removed. Wireless collection of data is faster and more reliable than physically retrieving dataloggers". Mr Crowther said.

Baker Hughes - Pipeline Monitoring

In a project with Baker Hughes, WFS supplied a Seatooth PPC system for wireless datalogging during pipeline pre-commissioning on a project in the Liwan 3-1 gas field South China Sea at water depth of 1000m.

The transmitter included a Seatooth PPC connected to a hydrotest skid and the receiver comprised a Seatooth PPC mounted on the remotely operated vehicle (ROV).

Previously, Baker Hughes was gathering this data with a ROV permanently stationed next to the pipelines taking readings from the sensors using a video camera and someone would write down in a book the these readings from a vessel above the pipeline. With the use of the Seatooth PPC data was downloaded wirelessly freeing manpower time and the ROV can be used to undertake other tasks.

i-Tech 7 - Wireless Video Monitoring

WFS Technologies wireless technology is being also used for inspection, monitoring and maintenance projects. In a project with i-Tech 7, WFS Technologies provided Seatooth Video, a subsea wireless video camera solution used for subsea construction and IRM

activities as it provides a 2nd perspective on complex tasks and in difficult to access places.

Seatooth Video, mounted on a Centurion QX work class ROV was used by i-Tech 7 for Woodside in Australia during a maintenance project on the field of the North Rankin. The project was carried out on the NRA second Trunkline (2TL) which transports two phase gas condensate from offshore facilities on the North West Shelf to the Karratha Gas Plant.

The project team was seeking a small camera solution to mount on an intervention tool. The camera would help with the removal of an internal plug and make the inside of the tool visible during this operation.

The engineers at i-Tech 7 and Woodside recognised that cabling would be a hazard in the conditions where the job was located, and that by using Seatooth Video would remove the need for a cable between the ROV and camera.

The i-Tech 7 team needed to ensure that progress was being made as planned, to minimise risk, time and cost. Without visibility, there would be no way of knowing if the tool had connected with the plug inside the guide and successfully removed it.

Seatooth Video streamed live video from inside the tool while it was operational, providing images to support lining up of the tool with the plug. The job was completed safely and without incident, and in a shorter time frame than anticipated.

At the Digital Energy Journal conference, Mr Crowther presented a video from the i-Tech 7 project, showing the tool trying to align to the subsea plug. The video shows that during the first attempt the tool hadn't grasped the plug properly. Without visibility from Seatooth Video, engineers would have risked damaging the plug which would have led into a major intervention task.

"WFS has also provided Seatooth Video deepwater systems to Fugro for the Moho Nord project in Congo. After this successful collaboration the companies agreed to enter a partnership to offer subsea wireless capability on all Fugro's FCV Work Class ROVs", Mr Crowther said.

Seatooth Video is available in three versions: Fixed Perspective with integrated lights, Pan-Tilt-Zoom enabling wide area coverage and the ability to zoom in on detail, and the third option of plugging in a third-party subsea camera.

You can watch a video of Mr Crowther's talk and download slides at **http://www.digitalenergyjournal.com/video/1333.aspx**

Oceaneering - subsea on your iPad

Subsea engineering company Oceaneering is seeing a big increase in requests from customers to monitor what is happening on tablet computers – including video from both topside and subsea activities. Is this a pathway to improved subsea efficiency?



Helping to wire up the subsea - Mark Stephens, director of Communications and Application Development, Oceaneering

Subsea engineering and applied technology company Oceaneering is seeing a big increase in requests from customers to be able to monitor their subsea and topsides activities on their tablet computers, including both video and data.

This is perhaps a sign of where the future is going, said Mark Stevens, director of Communications and Application Development, Oceaneering, speaking at the Digital Energy Journal Aberdeen forum, "Digital subsea - integrity management and monitoring", on June 2.

Most of us have seen live subsea video feeds, they were hard to avoid during the Macondo disaster.

Oceaneering carries between 200 and 250 live subsea video feeds from its remote operated vehicles at any time.

30 per cent of the video viewing is now being made on mobile devices, Mr Stevens said.

Customers are asking to see more and more about their subsea work on their mobile devices – including a live map of all of their subsea activities, starting with a map view, which they can zoom in to see the details.

To provide this data takes an enormous amount of software and communications infrastructure. Mr Stevens leads the "Communications and Application Development" division of Oceaneering, which is focussed on making this happen.

Video

Oceaneering has been doing live subsea video since 2001, and this summer it will have between 200 and 250 live subsea video feeds at any time.

Companies are increasingly using small ROVs for taking video, known as 'Observation ROVs', he said. These were initially developed following a request from Statoil, and now many companies are using them. "They literally just fly around the larger ROV providing a better perspective of the operations," he said.

There is a big drive for more live video streaming of topside equipment, he said, to support the subsea work. The company has seen an increased demand for their explosion proof cameras on rigs and vessels. "People want to see if the crane is working, if the material is on the deck."

Providing live video reduces the amount of telephone calls people need to make, to check the operations are going as they expect, he said.

It has started providing KLV/CoT video capabilities, where you insert the geographical co-ordinates of the ROV into a video stream. This means you can find the section of a video which was recorded from a certain geographical position. "When a client clicks on



Oceaneering - monitor your subsea activities live on your iPad and phone

a point on the map, the video shows up," he said.

This is useful for integrity management, for example if you would like to see a video image of a certain section of pipeline.

You can overlay symbols on the video, for example, showing data or equipment size.

Increasing emphasis is being placed on subsea lighting, to improve the video image. It helps that there have been big advances in LED lighting, including their reliability, which is "a factor of 10 better than it used to be," he said.

There is also a big growth in demand for 'photogrammetry' services, which means making measurements from photographs, he said.

Managing video data

With the 200-250 video feeds generating around 2 petabytes terabytes of data every day, just managing the data is becoming quite a challenge.

In one project, there were 29 ROVs in the water at one time, and every ROV had up to 6 cameras, so over 100 live video feeds were provided to the customer.

The size of video files has also steadily increased, as the industry has moved from 'SD' (standard definition) to HD (high definition) and now to 3D cameras over the past 10 years.

Oceaneering is moving to H265 video compression format, which gives you double the image resolution for the same data speed.

Many oil and gas companies are very reluctant to store the data internally. When faced with a request to store a petabyte, "the IT group said, 'I don't want anything to do with that', he said.

So Oceaneering manages the data for them. It uses both Google and Amazon cloud platforms.

"By posting it in a cloud environment, it is fairly secure," he said. "We can easily replicate the data, it comes up at the same speed in the UK as in Houston."

Data from tools

The subsea tools are also generating large amounts of data, he said.

For example, rotary brushes capture data about the brush revolutions per minute, and use a camera to see how the cleaning is going.

There is an ultrasonic testing (UT) tool which clamps around a device such as a pipe and sends ultrasound (high frequency non audible sound waves) into an object to test for internal flaws and characterise materials.

There is a chain link weld inspection tool, which wraps around chain links.

There is a digital radiography tool (a type of X-ray imaging) which will generate 50 megabytes per hour.

Oceaneering has inspection tools custom built around subsea operations available for rental globally.

There are also tools to continually monitor subsea assets, for example a tool for monitoring blow out preventers in real time and the position of the rams which can be updated every second.

Subsea communications

It would be very helpful to have more and more data from subsea operations available in real time, rather than being downloaded periodically.

At the moment, the only way to gather data from subsea equipment is for a ROV to move to different points in the field and download the data from equipment via acoustic or optical communication, he said, which means that the data is sent to the surface in batches.

"We're trying to get where the whole field is communicating in real time," he said.

Optical subsea communication means communicating data with (basically) flashing light.

With modern light emitting diodes, this can work over distances at least 150m, if there is minimal turbidity in the water and it is dark.

At the moment there are various optical communications modems on the market and no standard protocol, he said.

There are many different components which need to be connected, and so having open standards is essential to make equipment easier to plug together.

Once the data has reached a ROV, getting data to the surface is fairly easy, because the ROVs are connected via fiber embedded in the umbilical cable.

For communicating data from vessels to shore, it helps that standard maritime satellite communications bandwidth from rigs has steadily increased over the past few years from 256 kbps to 512 kbps, and "we're moving close to 1 mbps standard," he said.

Incident response

Mr Stevens said that his division spends about 10 per cent of its time helping companies put together incident response systems.

In the event of any subsea disaster, an oil and gas company would be required to set up a sophisticated incident response centre very quickly, including having a live view of everything that was happening both on the seabed and the surface, including video data and map based tracking.

As a practise drill, oil and gas companies regularly rehearse the process of setting an incident response centre up, he said.

Oceaneering can supply a 'skid' of IT equipment to support the data communications which would be required after an incident, he said.

The US authorities are emphasising the importance of oil and gas companies having what they call a 'Common Operating Picture', a military term which (roughly speaking) means an overall view of what is happening.

"We've been looking to define a Common Operating Picture," he said. "In my view it is the embodiment of all the data coming in. If I'm in a room, all of the data that comes up, that is the common operating picture."

The data can be displayed either on a very large screen, or on a smaller screen with multiple layers.

The Common Operating Picture could include both subsea video and data.

A map based interface is also an important part of a Common Operating Picture. Oceaneering has been doing a lot of work with ESRI, a provider of geographic information system (GIS) software, in this area.

Vessel tracking

Oil companies have a growing need for accurate data about the location of vessels working on their project.

All vessels greater than 300 gross tonnage are required to be equipped with 'Automatic Identification System' (AIS) transponders which broadcast their location.

There are a number of online services which provide AIS data for all vessels in a certain region, but they typically only provide the information via a web interface, so they can earn money by selling banner adverts around it, Mr Stevens said.

Operators are increasingly demanding vessel traffic data as an 'ingestible' data feed, he said.

In order to be able to provide this, Oceaneering recently acquired a U.S. company called Airsis, which provides a vessel tracking and doc management system called PortVision, which provides AIS as a data feed or as a web portal to view over 5 years of vessel movement history, he said.



OPC - UA makes subsea control more secure

A new interface standard for subsea control systems, based on 'OPC-UA', promises a secure, robust method of sharing subsea data.

A new interface standard for subsea control systems, called MDIS, based on OPC-UA (acronyms explained later) is being developed to make communications between subsea and top side control systems more robust and less expensive to implement in terms of time and effort needed for setup and aintain.



Darek Kominek

The standard addresses communications between 'Master Control Systems' or MCSs, which typically tie together subsea equipment, and a 'Distributed Control System', or DCS, which performs a similar function top-side. In other words, the standard aims at enabling many subsea components to be more easily controlled and monitored from one central control centre.

OPC-UA, the latest version of the OPC Foundation's OPC standard, was chosen as the communications backbone based in part on its platform and OS independence, powerful data modelling capabilities, and flexible connectivity options. OPC UA replaces the original OPC specifications which, are now commonly referred to as classic OPC.

Unlike OPC UA, classic OPC could only be run on Windows based PCs because it relied on Microsoft's proprietary "COM" (Component Object Model) and "DCOM" (Distributed Component Object Model) technologies to facilitate everything from security to the exchange of messages between OPC clients and OPC Servers.

As a dominant OS, Windows continues to be a prime target for hackers and malware applications which often focused on exploiting the vulnerabilities inherent in the broad functionality that was built into the DCOM sub-system.

Based on such concerns, IT departments typically blocked DCOM communications outside of their networks using firewalls. This protected the control and operations networks with the unfortunate side effect of effectively shutting down classic OPC traffic.

"DCOM was not well suited for use in an industrial environment where uninterrupted access to control automation data is essential," says Darek Kominek, global marketing manager for Matrikon OPC, a company which provides control automation data connectivity products based on the OPC standard.

Since OPC-UA does not require a Windows server to sit between control systems to facilitate sharing data between them, it can be now embedded directly on the devices and control systems themselves – making it possible for systems to communicate directly with each other as long as a OPC interface is available via wired or radio (wireless).

OPC-UA can carry different types of data, the main three are: streaming real time information; transferring archived data from a historian (e.g. if you want to view a graph of a day's worth of data for a particular temperature sensor); and alarms and conditions (e.g. to display an alarm when the temperature moves out of an acceptable temperature range).

It can work in environments with data disconnections, and can also work over wireless and satellite.

Designed for use in virtually every environment, OPC-UA can be embedded on devices with low power microprocessors and limited memory (eg. like a smart phone processor). In addition, OPC UA can even be implemented on devices that do use an operating system.

OPC-UA includes robust modelling capabilities, which means you can fully describe systems (like a valve, production line, or even an entire plant) without losing the context of what the various status and control readings mean.

This can be used to allow OPC UA clients to acquire complete device data from the OPC UA servers they connect to - reducing configuration errors and setup time. In contrast, OPC Classic only provided individual reading values with no mechanism to tie them together to identify which points were related the same piece of equipment.

Mr Kominek's company Matrikon builds tools to help equipment vendors embed OPC UA in their devices. It also designs OPC servers and software for doing the data conversions required by OPC Classic.

Acronyms

UA stands for 'unified architecture'.

OPC stands for Open Platform Communications". The explanation of the acronym was changed in 2011.

Previously OPC stood for "OLE for Process Control". OLE stands for "Object Linking and Embedding." The OPC standard was originally developed in 1996.

The 'MDIS' group

The OPC-UA standard form the OPC Foundation, has been adopted to serve as the communications backbone for a standard being developed by a group of companies under the name "MDIS" which stands for MCS DCS Interface Standardization.

Companies involved include ABB, Aker Solutions, BP, Cameron, Chevron, ConocoPhillips, Dril-Quip, Emerson, ENGlobal, ExxonMobil, FMC Technologies, GE Oil and Gas, Honeywell, Invensys, WoodGroup Kenny, Kongsberg, Petrobras, Proserv, Rockwell Automation, Shell, Siemens, Statoil, Total, W-Industries, Woodside and Yokogawa.

The group is managed by OTM Consulting, part of technology company Sagentia. It has a website at http://www.mdis-network.com/

It has a number of different groups, including some identifying what are the best objects to manage, and other group s "validating" the standard (checking that everything works).

Interconnectivity with OPC Classic

OPC-UA standard was designed to maximise interconnectivity, while retaining compatibility with the previous generation of OPC (OPC Classic).

For example, if you have a user interface (known in the jargon as a HMI or Human Machine Interface) which is based on classic OPC connectivity - it is still possible for it to acquire data from new OPC UA sources by using an OPC UA Proxy (an application that translates between OPC UA servers and classic OPC clients).

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Truphone - the end of mobile roaming charges?

Mobile communications company Truphone aims to make calls and data roaming charges a thing of the past.



A solution to the difficulties getting low cost, reliable, fast data connections while travelling? Sam Murray, business development manager at Truphone

UK mobile communications company Truphone has set up a service to enable you to make calls and send and receive data at local rates in 66 countries, including all of Europe, Australia, Hong Kong, the US, Canada, Mexico, Brazil, Argentina, China and Russia among others.

Many energy companies have already signed up as customers, according to Sam Murray, business development manager at Truphone, speaking at the Digital Energy Journal Aberdeen forum on June 4, “Improving IT Security and Infrastructure”.

To make the service work, Truphone has installed its own infrastructure in data centres in the Los Angeles, New York, London, Amsterdam, Hong Kong and Sydney, creating regional hubs to carry international voice and data traffic.

Due to agreements between countries (for example within the EU) it can also offer local rate calls for countries where it does not have its own equipment.

This list includes all of Europe (including Ukraine and Iceland), Argentina, Belarus, Brazil, Canada, China, French Guiana, Japan, Mexico, New Zealand, Russia, Singapore, Turkey.

As part of your Truphone account, you can choose to have a local phone number in any of the countries where Truphone has its own equipment (although you pay the same price whether you have a local phone number or not).

The aim is basically to try to build a global cellular phone network, not constrained by country borders – something which has never been done before. The current cellular network is basically lots of smaller networks stitched together, Mr Murray says.

Benefits

Roaming charges continue to be a big headache in many countries, with telecom companies seeing business travellers as an easy source of good money. “You get ripped off,” Mr Murray said.

Meanwhile, people's need to send data is rising exponentially, and people want to use the same applications on their mobile devices as they do in the office, regardless of their location.

Some company CIOs turn a blind eye to the expenditure employees incur whilst roaming because they know that reducing spending would be an enormous headache, Mr Murrays says.

Other CIOs make company rules on what you can do, such as restricting spending or banning roaming data use. "So you are worrying about that instead of getting on with your business," Mr Murray said.

Travelling executives sometimes switch their phones off or avoid sending data, due to concerns about calling costs, which can lead to business problems.

If people can't use their normal company devices on roaming, they will often use alternative methods, such as exchanging company files on wifi using 'DropBox' or going to an internet cafe, which can lead to further security problems.

By using Truphone you can also avoid the technical problems sometimes associated with roaming calls, due to the data which needs to be sent back to the home country. For example, if two Truphone subscribers from the UK travel to the US and call each other, the call stays in the US, providing superior call quality.

The offering

Your Truphone package includes a “bundle” of call minutes, texts and data usage from which you can make and receive calls from, to and between all of the 66 countries which make up the “Truphone World”.

Truphone subscribers are given a SIM card with a UK number, and one choice of foreign number (out of Australia, Hong Kong, Poland, Germany, Spain, the Netherlands, United Kingdom, United States), and they can additionally buy further phone numbers in the list of 8 countries above for £5 a month.

So if (for example) you travel to the US, you make a phone call, you automatically pay US local rates for the phone call, and your US number comes up on the recipients’ phone as your number. This should make them more likely to call you back, if someone in the US is more comfortable calling a US number, Mr Murray said.

If two Truphone users in the US phone each other, even though their phones are registered in the UK, they will pay normal US mobile phone rates.

Truphone subscribers pay for a bundle of minutes and data, the same way as you do with your personal phone, and you can use this anywhere in the world.

Truphone has installed its own switches in 6 countries around the world, which route its subscriber’s traffic. So once you have made a call in (for example) the UK, your call is routed to Truphone’s UK switch, which sends the call to the switch closest to your recipient. So all the expensive international section of the phone call is handled by Truphone.

As well as reducing the price, this system can help improve quality and security of the call.

The company has a support service geared for business use, where you can speak directly to engineers if you have any problem, regardless of your location or the time of day.

Watch a video of Sam Murray’s talk at **http://www.digitalenergyjournal.com/video/1366.aspx**

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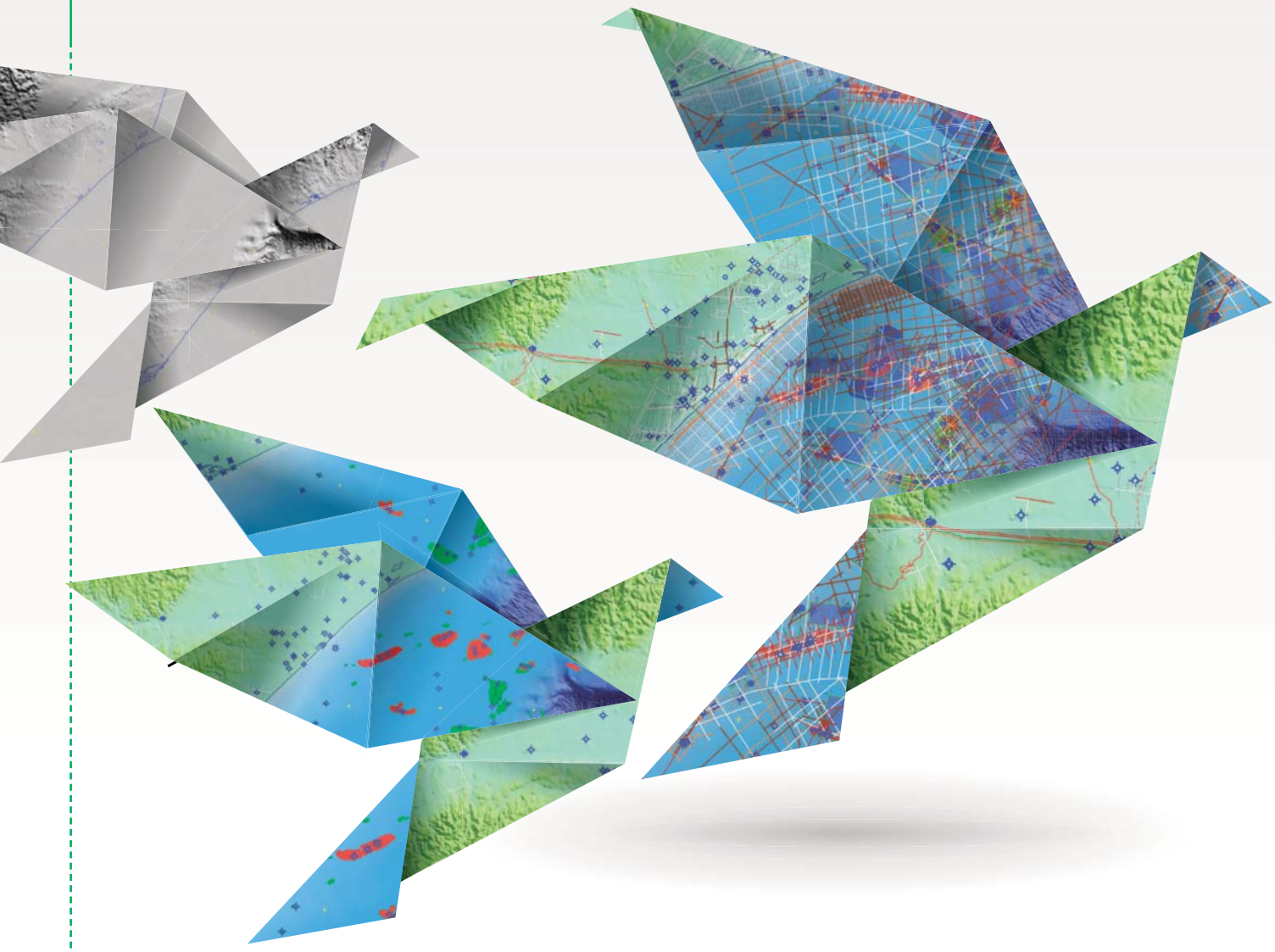
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