

digital energy journal

Digital technology and offshore safety

Reducing industry complexity

Oracle's Exadata - moving data faster

Making data management exciting to managers

Understanding your use of bandwidth

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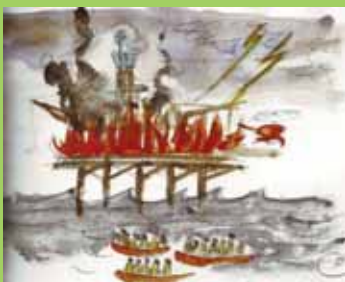
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What digital technology can contribute to safety?

Sitting in our air-conditioned offices in London, Aberdeen or Houston, viewing the world through our twin-screen desktop computers, it is sometimes easy to forget that the world of oil and gas is brought to us by men and women who endure rough seas or harsh deserts, heat and humidity or -20^o C, snakes and/or mosquitoes, bumpy flights, long periods away from home....if they are lucky, not all on the same project. They should not also have to risk life and limb.

This set me thinking about where digital technology - ideas that I have read about in this Journal or caused to be presented at one of our Finding Petroleum events - could make a real contribution to occupational safety (including some aspects of operational integrity, which I know is a very broad topic).

I've heard that editors don't like lists - nonetheless, here's mine:

Wireless seismic - to change what you'll see if you ever visit a big onshore seismic or transition-zone seismic crew, namely that most people on it are locals, temporary employees, hauling around huge amounts of cable, wading through swamps.

Simulator-based training - to improve the competence of the large number of 'blue collar' workers who enable frontier drilling operations, many with not very much training.

Management and control of drilling operations - to turn the vast amount of raw data (on mud properties, well condition, pressures, flow etc) that arrives at the rig floor into easily visualized, understandable and actionable information and knowledge.

Communications - to allow the information being generated on a rig (see above) to be transmitted in real time to 'HQ' so it can be monitored by specialists, in support of the drilling supervisors on location.

Production Operations - to remove as many people as possible from the vicinity of flowing oil and gas by taking advantage of automation and remote control via the Digital Oil Field.

DVDs - maybe industry associations could produce a series aimed at reducing the unsafe acts that still seem to blight our industry? There's quite a list - not wearing personal protective equipment, not wearing seat belts, not taking precautions against malaria, risking HIV or hepatitis infection, climbing without a harness (or being out on the back deck), not respecting electricity.

At one time, one of the more hazardous pursuits was for the occupants of the little 'chase' boats that buzzed around the many long cables being towed by 3D seismic vessels, fixing any problems that came up with the cables, the paravanes etc....a good way to get tipped into the sea. Perhaps somebody has invented a digital solution - if so, I've not heard about it.

Maybe you have your own list? As ever, comments or criticism always welcome, probably best via a blog on our Finding Petroleum social network.



David Bamford is non-executive director of Tullow Oil, and a past head of exploration, West Africa and geophysics with BP

Standardization is the enabler for our ability to integrate knowledge across the organization. Open standards from Energistics are the key to Integrated Operations being 'the way to operate' in Statoil.

Peter Eilsø Nielsen
Chief Geologist Production
Statoil



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David Bamford

What digital technology can contribute to safety?



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What are your capabilities?

Most oil and gas industry companies define what they do by their products. But they would be better off defining what they do by their capabilities (ie what they can do which people will pay a premium for), and their relationships. Most importantly, understand that the most important capabilities in an industry can change



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Doing more with your bandwidth

ISN Solutions has advice about how oil and gas companies can get a better understanding of how network bandwidth is being used, both within your office and between sites, including via satellite – and how to work with your corporate software reliably from an offshore platform, and how to enable geophysicists to work on their models from the airport lounge



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Making the industry less complex

Some of the most difficult issues Shell has to deal with are no longer the technical ones, says Matthias Bichsel, director of projects and technology at Shell



Matthias Bichsel

Dr Matthias Bichsel, member of the Executive Committee of Royal Dutch Shell and director of its Projects and Technology business, said that in the past, “most complexity in projects was in the technical realm.”

But now, some of the most complex and difficult issues Shell has to deal with are meeting the requirements of the people who live in areas where Shell would like to operate, he said.

He was speaking at the Offshore Europe (Aberdeen) plenary session on September 6, “managing complexity”.

The specifics of local requirements and needs “vary from country to country,” he said, and include “requirements or local contracting, local workforce development and employment, both direct and indirect (using local contractors).”

For Shell’s proposed Beaufort Sea (Arctic) projects, “The key is to understand what the local people want. “There is a desire for development, but on their own terms and in a way that safeguards their traditional way of life.”

For example, the noise of drilling operations could have an impact on whaling, which is important to native people. “We have developed a technology to produce a curtain of bubbles of air around the platform which shield noise, to protect the mammals and fish,” he said.

With Arctic projects, “the complexities aren’t really high-tech; drilling for instance is straightforward,” he said. “However, the Arctic presents a complex set of non technical risks.”

For instance, it is important to show local residents that the company can deal with a spill.

“There’s no reason to assume it is not possible [to deal with a spill in the Arctic],” he said. The flow rates are much lower – these are not high pressure wells–, the water is shallow hence oil is relatively easy to capture in the very unlikely case of a blow out.

“Moreover, Shell has invested in 3-tier spill response capability to deal with any

such eventuality. Also, significant R&D was undertaken to demonstrate, for instance, how to deal with oil under and in broken ice.

NGOs and the public

A secondary “public” you have to contend with is the non governmental organisations (NGOs), he said.

For example, “people who don’t live in the Arctic who have perhaps a perception about what is or isn’t possible and what should or should not be done.”

When it comes to working with these groups, “we are pleased that some NGOs are willing to work with us to find solutions that make sense for everybody. Sadly, others are not willing to even talk,” he said.

The fact that much of the public believes that renewable energy offers a future in the short term can be a problem.

“Some seem to believe that the only answer [to the energy challenge] lies in renewables. It’s simply not going to happen in the short term. Even if renewables grew in double digits for the next 10 years, it won’t get to 20 per cent by 2020. Hence, fossil fuels are still needed to cover a large portion of the energy demand.

The industry could have done more to get its view on gas across. “As an industry we haven’t really lobbied very hard, really in a concerted way,” he said.

The previous day, Dr. Bichsel had attended the World Engineers Convention in Geneva. “It was interesting to see oil and gas didn’t really figure in the discussion,” he said, despite the fact that oil and gas will need to figure prominently in the energy mix even by 2050.

Simplifying operations

Shell is making big efforts to try to find ways to reduce complexity in its operations, including pushing for more standardised designs and simplified contracting.

The company has an initiative called ESSA, which stands for eliminate, simplify, standardise and automate, to try to reduce complexity. “We’re simplifying our frameworks, to abolish unnecessary double checking and increase control strength,” he said. This has a direct impact on tendering, making it faster and cheaper.

“I think there are opportunities in being smarter in the supply chain. For instance, we are running a 3 year programme to sim-

plify and de-spec all our standards to ensure they are up-to-date and can be applied globally,” he said.

There are big benefits to the company of reducing the cost of the supply chain. “Supply chain management and logistics are big factors in how much [overall] value we generate,” he said.

In order for more collaboration between companies, “you require trust,” Mr Bichsel said. “Many times we tried to work together [with other companies] the trust was mis-used.”

Shell is also lengthening its deepwater rig charters. This allows real and long term collaboration with the rig contractors to train and develop their staff, come up with new safety measures and overall to ensure safe operations.

“We did that because we saw a dilution of competence on the rig floor” [due to the influx of many new deepwater rigs]

Shell charters its currently 10 strong deepwater rig fleet on average on 5 year contracts. “Last year we had contracts which go out even for 10 years,” he said.

The company is also aiming to use the same design more than once. For instance, it has done this for Gulf of Mexico tension leg platforms and floating LNG. “Our ‘design one, build many’ approach gives better construction, operations and maintenance, flexibility of deployment and scope for successful deployment,” he said.

Automation can help too. “Every project now has ‘smartness’ designed in from the start with the right level of automation to reduce cost, improve safety and reliability and reduce the environmental footprint,” he said. “That’s the kind of thing we need to manage the growing complexity of offshore.”

Staffing

One Mr Bichsel doesn’t believe is getting more complex is staffing, which has always been a problem. Discussions about people shortages were going on when he joined the industry in 1981, he said. However, it is true that in the Western world there are less young engineers, but this is offset by the many thousands of engineers and scientist that graduate in India and Asia in general and are very happy to join the energy industry.

He suggested it is up to all of us to give young engineers responsibility early.

Remotely operated wells 'safer and simpler'

Remotely operated wells are safer, simpler and easier to manage, says Ron Kramer, senior advisor, Upstream Production Operations at Shell

"If you have an offshore facility designed for unmanned operation, it can be inherently safer and simpler, with less equipment, less accommodation and less logistics," said Ron Cramer, senior advisor upstream production operations at Shell. He was speaking at a technical session at Offshore Europe conference in Aberdeen, presenting a paper entitled "Remote Operations - A Remote Possibility, or the Way We Do Things Round Here?" [*SPE - 145224*].

The primary and most important benefit is reduced operator exposure to process and travel hazards. "Significantly less trips are required to the remote production facilities in trucks, helicopters and boats; along with less hours working in hazardous areas such as well heads, pumps and compressors, hence the operation is considerably safer."

"You get increased staff productivity. Why? Because you're operating the plant remotely and electronically with control actions performed more or less instantaneously."

"A large, onshore, European gas field is totally automated with fast well and compressor remote stop/start capability. It's like starting a car. You push a button and indicate how much gas is required, the system then selects the wells and starts them automatically."

"If you want to do it manually you do it one well at the time. If the operator has to travel to the well, it takes time to get there – the further the well and the greater the distance between wells, the longer it takes and the more production is deferred."

With remote operations you can also involve scarce global experts on specific issues. "You can make the information globally available, such that remote experts have the problem evidence at their finger tips, this enables collaboration with local staff, both viewing the same real time data at the same time and in the same format, for more effective and faster problem solving."

In West African fields remote operation systems are being installed for safety and production reasons. "Sending operators to the wells is becoming progressively more difficult," he said. Similarly in the Hurricane prone Gulf of Mexico, platforms are evacuated and shut-down when storms approach. Even though these activities are performed with professionalism, the staff are subjected to travel hazards and shut downs result in

production losses. Consequently there are opportunities to leverage remote operations, inclusive of continuously manned remote control rooms to increase production and safety, he said.

"In the Gulf of Mexico fields expert staff offshore visit frequency has been substantially reduced by utilizing an onshore facility called the 'Bridge' where skilled analysts continuously monitor the assets and flag and pre-process the information for the engineers," he said.

For onshore fields the most significant benefit of remote operations is in reducing staff road travel to visit the remote wells - one of the biggest sources of accidents. Ironically many times the operator didn't have to go to the well because it hadn't changed.

"For virtually all oil companies, driving and other travel related incidents are a significant issue. Too many people get injured and killed every year," he said.

Of secondary importance to safety you can also use the real time data required for remote operations to optimize production. For example, if you're doing gas lift, you can use real time data to lift more oil using less gas lift gas. The real time data can also help unravel well/reservoir problems sooner, such that they can be fixed sooner to produce more oil or gas.

It is not hard to run plant remotely. The technologies to remotely start and stop wells, pumps and compressors are mature. "We've had them in refineries for 50 years. The technology we have now is fit for remote operations purposes."

"We're going to have thousands of more wells over the next 10 years. That is going to change the way we operate, because it will be difficult to find and train staff to run the process the old, manual way," he said. "So the amount of automation is certainly going to increase."

"If we have thousands of new wells, I believe that robotics is something we'll have more and more of," he said, including tasks like robotic sampling and well testing.

Control and authority

Operators have to be able to adjust the process, based on what they observe. "There's not much point in doing remote surveillance if you don't take action to improve the efficiency and integrity of the production processes."

The best remote operators should be 'looking for trouble' or in other words proactively looking at things which could possibly be going awry or might be about to go wrong, so they can be put right as fast as possible. For example, if a well starts to water out, it may be expedient to close-in that well and increase production from other wells to compensate for the loss.

You need to make sure that authority is delegated to those who can take action in a timely manner – if something goes wrong at 3 am on a Sunday morning, staff on duty need to be capable of analyzing the situation and empowered to take the necessary actions to render the process safe.

Getting it implemented

Persuading people to switch to remote operations is not always easy. "The operator, like most human beings may be reluctant to change and reverts to operating the field the old manual and travel intensive way."

The main reason why it can be a struggle to implement remote systems is "resistance to change – the operator needs to be motivated, there needs to be something in it for him," he said.

"If you want to do things down-manned or unmanned, you've really got to change the philosophy of how you operate and why," he said. "That 'why' needs to be clear to all concerned. You need to change your standards and guidelines and procedures."

The best way to move forward for brown fields is to put an operations philosophy in place, establish guidelines and communicate to the operator that this will make his life easier, using the power of suggestion to strive to "make it his idea." "If you've got management pushing it and operations staff are onboard and "own it," it will be successful," he said.

Mr. Cramer related one case where staff were reluctant to use newly installed remote operations equipment and continued visiting remote well heads unnecessarily, rather than using newly installed offshore electronic control and monitoring facilities. Management forced them to use the remote data by taking the boat away, with significant OPEX and safety gains. Forcing tools of this nature are far from ideal, it is much better to persuade the operator to effectively use the new tools.

Change management is not such a problem for green fields, he said.

Santos – cut production data processing time

Australian oil company Santos has managed to cut the amount of time it takes to process production data from 120 hours to 10 hours, using Oracle's new "Exadata" computer

Australian oil company Santos has managed to cut the amount of time it takes to process production data from 120 hours to 10 hours, using Oracle's new "Exadata" computer, said Steven Benn, manager of surface information systems, Santos, speaking at the Oracle OpenWorld event in San Francisco in October.

Production allocation is managing the data about production history, calculating and tracking the hydrocarbon products from the well head to the point of sale, to report to the joint venture partners and to regulators, and also for managing invoicing and taxes, forecasting and budgeting.

Santos' production allocation system is very complex because there are 17 different joint venture projects with different companies in each one. Each field has different hydrocarbons (including hydrocarbons changing from gas to condensate within the system), different wells, different flows and different partnerships involved. The calculation needs a number of iterations.

There are 400 oil wells, 820 gas wells,

product from other companies and gas storage in the system. There are 3 plant sites.

Santos has 190 gas fields and 115 oil fields in production, 5,600km of pipelines and flow lines via 15 satellite facilities.

There are complex commercial arrangements (swaps, first in first out agreements).

The allocation is calculated on the basis of a mass balance from various flow path meeting points, where the amount of flow into the node has to be equal to the amount of the flow out (unless any is stored).

The company was missing reporting deadlines, due to the time taken to process the data. The quarterly reporting to the Australian Stock Exchange was going out to the market with "preliminary" production data.

This meant that it was using old historical data to make major business decisions, such as for new capital projects.

There was incorrect invoicing, delayed invoicing (leading to reduced revenues), minimal quality control.

"Our production allocation system is

incredibly complex system with a large amount of variables," he said. "There is extremely large processing, a lot of re-work, having to do stuff consecutively."

So the company was under a lot of pressure to find a faster computer system for processing the data.

After managing to cut production data processing time from 120 hours to 10 hours using Oracle's Exadata, Mr Benn tried some other software packages on its Exadata computer and saw reduction in data processing time for other packages it is using, including Primavera P6, Spotfire, Fekete, PEEP, Oil Field Manager (OFM).

The Babelfish tool, which displays production and operational data, could process data in 2 minutes, when it previously took 6.5 hours.

Now Santos is considering using the system for other applications, and particularly for spatial data. It would also like software vendors to look at ways to make their products run more optimally over the hardware.



Cloud subsurface data

The benefits of having subsurface data on the cloud are well understood – but how well does it work? Oracle is doing a 'proof of concept' with Stanford University to find out

Having subsurface data stored on the cloud means that you don't have to move it anywhere before doing server computations. By sharing server power between all your staff, you can do more with the same amount of computer power, so long as you're not constrained by computer power at busy times.

You can have more control over the governance of the systems and standards people are following. It makes it easier to do patching and updates, including hardware patches.

"It makes a big difference," said Melinda McDade, Oracle Principal Software Engineer, speaking at the Oracle OpenWorld conference in San Francisco in October 2011. "We can do one big patch that fixes everything."

You can manage all of your data centrally, to make sure it isn't lost on people's desktop computers.

Systems like this are very good for applications which require a lot of computation, such as MonteCarlo simulation, where

you run the same equation many times with slightly different input variables, said Dr. Stewart A. Levin, Stanford Consulting Professor of Geophysics, retired Halliburton Fellow, who is involved in the 'proof of concept' with Oracle.

Reservoir simulation can be done "relatively easily" on a cloud environment, he said.

Doing seismic imaging gets tougher because people need to work directly with large amounts of data, over a terabyte sometimes, he says.

However there can be problems with cloud systems if lots of people want to get online at the same time, for example during a license round.

You get huge spikes in demand, the rest of the time its 5 percent utilization."

In the past, seismic data itself was not stored on tape, not in databases. A piece of seismic data is not easy to manage in a database, because it is just a combination of a number of different waves (traces). But the

more powerful Oracle databases can handle it.

Dr Levin is working with Oracle to develop ways to do complex multi azimuth seismic imaging over a cloud type set up.

The trial project was done on a 60 terabyte data set in SEG Advanced Modeling (SEAM) format, which had 2 terabytes of metadata.

Oracle is also looking at storing some of the data in PPDM (professional petroleum data model) format.

In particular it looked at a process called "offset vector tiles", single fold subsets of a seismic survey, which are then sorted together in different ways (eg sorted by offset or azimuth) to find the way which will present the clearest image, a process which needs a lot of computing power and database work.

It is experimenting with the Apache Hadoop software framework for data intensive distributed applications, to run the tools which sort the data.



High performance data management

The more data your company can process, the better decisions you can make, reckons Oracle's Jay Hollingsworth

Ultimate business performance in the oil and gas industry comes down to the "size of data set that you can operate on, so you can make faster decisions, or decisions with more data taken into account," said Jay Hollingsworth, director of the Oil and Gas Industry Business Unit at Oracle.

He was speaking at the 5th Annual Oil & Gas Day at Oracle's OpenWorld in San Francisco in October.

The conventional approach to E&P management, which focuses on having data labelled and stored properly, which "we've talked about for a really long time," has the problem that it "doesn't scale," he said.

In other words, the volumes of data we are talking about require a completely different approach to data management, with automated tools to move data to the right place and work out what is happening.

There have been plenty efforts to make digital oilfield work over the years, to enable people to have the best available data to make the best decisions, but "somehow it hasn't all worked out," he said.

"There seems to be a breakdown in every chain in this. People can't even get the answers to simple questions, such as, 'has anything changed since yesterday.'"

"So we're going to propose high performance data management."

Mr Hollingsworth is a director of the PPDM association and technical representative at Energistics. Before joining Oracle, Mr Hollingsworth was consulting data architect at Landmark Graphics and principal data architect at Schlumberger Information Solutions.

Oracle

Oracle has the tools to "move that data from where it comes from to where it needs to go," he says.



Oracle CEO Larry Ellison unveiled his "Exalytics" machine at Oracle OpenWorld

What is special about Oracle is that, as well as a world leader in database software, it has acquired a number of hardware

and software companies over the past decade, and is putting their expertise together to make a hardware and software system for storing and working with data which runs extremely quickly.

If the objective is to process data faster, or process more data in the same amount of time, you need a system which can work with data as fast as possible.

Oracle has launched the Exadata, Exalytics and Exalogic systems, which are hardware designed for running databases and analytical tools. The database can run directly in the computer's memory, rather than have the computer memory calling for data from a separate data store. "So it runs extremely fast," he said.

Exadata "is as fast as it can possibly be," he said. "The hardware is built to run that one thing extremely well."

Normally, companies have IT systems with hardware and software built by many different manufacturers, which is equivalent to car with parts designed by many different companies and bolted together.

The Oracle solution, with everything all designed to run together, is equivalent to what we normally expect from a car, "where everything was made by one company designed to work as an integrated whole."

Mr Hollingsworth says he thinks it is inevitable that the oil and gas industry will end up using lots of Oracle products, because it is the "only company that can provide both the hardware and software" to make high performance data management work.

"Oracle is the only company that has the hardware and software stack to solve this problem," he said. "The long standing problems we have in the oil industry are solvable."

Why we need more data

Mr Hollingsworth explained some of the reasons the oil and gas industry needs more data.

Business objectives can change between wanting to maximize production or maximize financial returns, and any software business management system must be able to switch between the different objectives.

Most new drilling projects are in more difficult parts of the world, or closer to residential areas and so under more scrutiny.

High oil prices mean much more demand to reduce non productive time.

Operators are working more with offset well data, and want to provide that to

drillers.

There is pressure to be able to monitor drilling and production wells in real time, particularly after the Deepwater Horizon disaster.

We have fewer engineers, and they have less experience, and need to make more complicated decisions on more wells.

Database challenges

The first problem with data is figuring out how to store it.

Mr Hollingsworth recalls his time at university, when he heard about a fellow student (called Michael Dell) who was running a business in his dorm room installing 5 megabyte hard drives in personal computers.

Now people talk about petabytes of data. All of this has to be managed and stored so you and your colleagues can find the right data later.

Systems have been built to store oil and gas data, but they are not developing as fast as the number of different data types is changing.

For example, if you have interpreted the same seismic data in 6 different ways, there's no obvious way to manage the different versions.

Subsurface databases might not be designed to hold gravity data and electromagnetic data.

"If you buy a commercial [database] product and we come up with a new drilling technique, that database isn't going to know how to hold that data. Those kinds of products don't deal with it because it's newer or not well understood by the data business."

There is also plenty of data which is only partly structured, such as forms which contain free text.

"That's like the drilling morning report, where it is structured in the sense that it comes in a file and it has an organisation, but inside there are big comments field, what did you do over the last hour? 'I circulated 23 minutes, then we increased the mud weight to this.'"

"I call that semi-structured data because it has a structure, but it has a column for comment or remark."

"Managing that unstructured text is a different problem to managing your text document and your web pages."

Real time data flows

More difficult than working out how to store your data, is working out what to do with the

Report: Oracle OpenWorld Oil and Gas Day

continuous flows of data from the field, the 'real time data'.

In the past, the "analyse / execute" loop for drilling problems might involve someone monitoring the hook load on the drill bit from a shore office, and if there was suddenly a change (indicating a possible problem downhole), which the driller might not have noticed, someone in the office would phone the driller and tell him.

"Assuming that the relationships are such that the driller won't mind taking advice from a college guy in Dallas," he said.

But now the data is moving much faster. "We used to measure production monthly, then daily, then hourly, now we can measure production in real time every second or every tenth of a second," he said.

"At each step, in order to do technical analysis, I have to integrate different data types. I have to pull data streams, and I need additional data types," he said.

"You need infrastructure that can enable you to capture, analyse and execute data at different time scales, depending on if you're doing reservoir characterization, drilling or production."

A driller might want to take immediate action based on the data. "If he can see a screen that says you're about to enter a thief zone he's got to act on that data now."

A reservoir engineer might make decisions over a longer period of time. "If you're drilling along and you accidentally start to leave the zone, you'll be able to figure that out over the course of the day and adjust accordingly to put that bit back."

Then there are long term decisions that can be made on drilling data, if you have stored it. One company recently published a SPE paper about how it took many years of drilling data to look at performance of individual drilling crews, and found that some crews were much better than others at certain jobs. "You can only do that if you have access to the full real time data over multiple wells."

It would also be helpful if the cost of working with real time data would reduce. Many companies have real time operations centres, but find them so expensive to run, they only use them on the most high risk wells, he said.

Oracle solutions

To automate the real time data management, Oracle acquired an "amazingly cool piece of technology" called Real Time Decisions, which can help you work out which are the variables you need to be keeping most attention on, he said.

"It watches the decisions that you made and updates itself based on the choices that you made," he said. "It is capable of learning through the life of the enterprise."

"You decide, in a certain situation, you're going to pull up and circulate for a while. It notices that if you do that often enough, it will be saying, the last 4 times you did this you pulled up and circulated for a while, maybe you should do that now."

Oracle is also working with different types of database structures which can compare and manage data in different ways, with

systems known as "NoSQL" or "not only SQL". so you can look at all the data which relates to the same depth, or the same point in time, no matter how the data is actually stored.

Oracle Site Hub is a system which organisations can use to get all of the data related to a specific geographic location together out of other systems.

Oracle Data Integrator is a tool which is designed to help move data from one place to another periodically.

Oracle GoldenGate is a tool to manage real time data integrations and keep systems continuously integrated.

The Oracle data mining tools can run directly on the database, rather than pulling data out of the database to examine it. This means it can run much faster.

Oracle is developing a version of **R programming language**, an open source statistical analysis system, which can run directly inside the database. This language is currently being taught in university statistics courses, he says.

Oracle Complex Event Processing is a system for building applications to filter, correlate and process 'events' in real time. An 'event' can be defined any way you want, for example if someone pushes a button, or a value exceeds a certain limit, that can be configured as an 'event'. The system can then put together a dashboard, or alert system, to tell people what they need to know. This tool can integrate with other systems, such as personnel systems or business activity monitoring.



Developments at Oracle OpenWorld

The Oracle oil and gas day in Oracle OpenWorld, San Francisco in October included presentations from Occidental Petroleum, Transocean, Key Energy Services and CSC about their work with Oracle

"The industry has become increasingly complex, so there's a need to rethink the IT systems of oil and gas companies," says Bernard Goor, VP process industries with Oracle, speaking at Oracle OpenWorld.

"The oil and gas industry sees an explosion of data, so companies need systems to analyse data," he said.

IT systems in the future will help companies predict what is going to happen, rather than just reacting to things, he said.

Many companies do not get as much analytic services out of their data as they could do.

They have the data they need, but they don't do all the work they need to do on it, to make the most with it. "You need to close the gap and react much faster," he said.

Mr Goor suggests that Oracle can help, with its new The Exadata (database) tool which can capture massive amounts of data, and its Exalytics tool which can do fast processing on it.

Awards

Oracle has given awards to Chesapeake Energy, Key Energy, Enbridge and BP, for "innovation and technology leadership" in the

oil and gas industry.

The awards were presented at Oracle's 5th Annual Oil and Gas Day during the Oracle OpenWorld conference in San Francisco

Chesapeake won the award in the "exploration and production" category, for its work implementing Oracle's PeopleSoft Human Capital Management, Oracle Business Intelligence and Oracle Hyperion solutions. Its midstream companies have recently embarked on the implementation of Oracle's PeopleSoft Financials and Oracle's supply chain and manufacturing solutions. The company is the second largest US producer

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of natural gas with 12,000 employees.

Cathy Tomkins, CIO and SVP of IT, says that the company has grown in size and complexity over the past 5-6 years, in particular with a project to try to integrate oilfield services with the midstream. "I feel the commitment on Oracle's part to go from a software vendor to a business partner," she said.

Key Energy Services won the award in the "oilfield services and drilling" category. The company recently implemented an Oracle Business Intelligence system to help staff manage business performance and spot trends, leading to increased efficiency and improved customer services. Key employs around 9,900 people and is based in Houston.

Enbridge won the "midstream" category award. The company is transforming its order to cash process in the liquids pipelines division, which will lead to improvements to customer service, delivery on business flexi-



Taking over part of San Francisco - the annual Oracle OpenWorld event, which attracts over 45,000 attendees, includes a special session about using Oracle products in the oil and gas industry

bility, additional visibility into business processes through analytics, and further optimization of operations through service and IT standardization on Oracle's Fusion Mid-

stream. The company runs crude oil and liquids pipelines, and provides natural gas transportation and distribution, and renewable energy.

BP won the "downstream" category award. It recently implemented Oracle's Siebel customer relationship management system, which helps the company improve the customer experience in a number of business touch points (account managers, field sales) and business channels (email, fax, voice, Web). BP now has 330,000 customers' data in the system and handles 70,000 calls a month around the world using one instance of Siebel.

CSC – getting it on a dashboard

IT consulting company CSC, an Oracle partner, wants to help decision makers at oil and gas companies get all the information they need to work with readily available.

The idea is that people making decisions at different levels of the company should have performance data immediately available to them, so they can test what the likely results will be based on different scenarios or choices.

The company has a tool called Petroleum Enterprise Intelligence, to get the right types of information to the right people.

CSC defines several different elements of enterprise intelligence: "business intelligence" (about profit and cost); "process intelligence" (to work out best practise processes); "location intelligence" (knowing where things are to make decisions); and "people intelligence" (understanding organisational capabilities). CSC has used the location intelligence project with military to track what they are moving around and monitor traffic.

CSC has 95,000 employees and provides consulting, systems integration and outsourcing. It has a global alliance partnership with Oracle and works with most of the oil majors and oil service companies to help companies do more with their data.

The data challenges are getting harder and harder. We have 44 times as much data in 2012 as we had in 2009," says Rus Records CTO, Chemical, Energy, and Natural Resources global practice at CSC.

Companies are managing larger projects with fewer engineers – one engineer can have 10 fields and 1000 wells to manage. "One way to deal with it is make information more available to people," he says.

Mr Records suggests an 'intelligent services architecture', which has a top layer with handheld terminals, web browsers, ipads, video displays and collaboration rooms.

Under that: a layer with business intelligence and analytics, including location and movement tracking.

Under that: there can be a layer for complex event processing and workflow management, where the computer systems try to work out if there is something going on which people should be alerted to.

Underneath this is all the data systems, which can be stored in different places. "We use the term 'data federation' – we'll pull out data from wherever we need it (we may need to cache it for performance reasons," he said.

So the system can take data out of all the different financial systems, supply chain systems.

A system like this can enable technical people to see business and maintenance information which they can use when they make decisions – such as how well the supplier has performed in the past.

You can use the data to answer questions like, how does the production volume change if the frac spacing is changed?

You can see the information on a laptop, iPad or iPhone. "There's no additional configuration to make your solution mobile," he said.

Occidental

Occidental Petroleum, the 4th largest oil and gas company in the US, has recently embarked on a major project to consolidate 12 different financial systems down to one, said Don Moore, VP and CIO, speaking at the Oracle OpenWorld conference in San Francisco in October.

The company mainly focuses on large, brownfield or 'legacy' oil and gas assets, he said.

It has operations in North and South America, Libya, Iraq, Yemen, Oman. There are a lot of US land operations, particularly in the Permian Basin. It is the largest acreage owner in California. The company is also the leading North American manufacturer of vinyls.

The company sells everything as soon as it is produced, and has sophisticated trading systems.

With the financial systems project, "we started 2/3 years ago realising we had many pieces of financial systems we had to take care of," he said.

"We had an executive (before 2000) who said we didn't need a purchasing department.

In 2002 to 2003 we started rebuilding one."

"The thing it was really driven on was project management. The number 1 thing people were concerned about is ability to

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manage the projects. We have 50,000 projects of some sort we have to manage.”

Other objectives included “getting the financial information to the operations people,” he said.

“We’ve much improved how we’re spending money. We have control of our inventory better than we ever did before. These are real dollars [of saving].”

“The data relates to the business process, not the accounting structure. The projects are driving the whole system, not the general ledger. We have a consistent set of global processes.”

“We had to clean up a lot of data.”

Occidental now has much better management of its different processes, and could run most of its processed (such as accounts or supply chain management) from one place in the world if it wanted to.

It can provide better support to its regional organisations.

It expects a range of different results from its IT systems including helping make better decisions, getting improved results and operations efficiency, extending reservoir life, getting competitive advantage, and improved performance at the drill bit. “It’s all about better, faster, decisions,” he said.

Getting a standard IT infrastructure was the most important thing we did,” he said. “It’s a foundation for delivering modern oil-field solutions. We’re going to stay on a standard set of technologies.”

Another benefit of the IT systems is improved management of capital, and keeping close to predictions. “If you say you’re going to spend \$9bn and you don’t, that’s a negative for Wall St.”

We’ve been leveraging our tools and techniques so we have better project management.

“A lot of work goes into our G+G data. We have a standard set of geoscience tools.”

“I was in Bahrain this time last year, operations managers told me how quickly they’d brought the field up with all of these tools,” he said. “The Bahrain government was sending letters of appreciation.”

A major recent project has been improving the company’s financial management department.

The next development, Mr Moore calls the ‘digital canopy’, which will be providing anywhere, anytime, access to field operations systems, including asset lifecycle management, maintenance management and people safety.

Key Energy Services

Key Energy Services recently installed a major business intelligence tool, in response to

complaints from clients that “you don’t have the right information to make decisions,” says John Hood, CIO of Key Energy Services.

Key is a specialist in land-based well services, including fishing (retrieving objects stuck in the well), fluid management, rental services, rig services, intervention services and high pressure equipment.

Mr Hood sees a 5 step “maturity scale” with how companies use business intelligence, when they get from now knowing about it at all, to considering the opportunities, to having a standardised approach to it, then an ‘enterprise approach’ to it, and finally when it transforms the company.

The company had made a lot of effort in its enterprise resource planning system. “People thought they’re going to get lots of good information because they put it in an ERP,” he said.

“Guess what, you don’t.”

The company hired Hitachi Consulting, part of Japanese technology giant Hitachi, to implement its business intelligence system. “When you pick BI apps you have to pick the right consulting firm,” he said.

Hitachi was good at encouraging the use of off the shelf solutions where that was practical. “A lot of firms want to make money on BI by doing custom work. We decided there was no need in the world to customise a financial reporting package. Oracle has already built all that stuff.”

Secondly you need good master data. “Just because you have an ERP system doesn’t mean you have good master data,” he said.

Key uses various different systems to provide master data, including employee data and asset data.

With good master data management, it is easy to change around management reports when asked to.

When putting together a business intelligence system it is important to understand the different business ‘rhythms’, or how people in different roles operate on different time scales, although using the same data. “Hitachi helped us understand that executives want to see things differently to others,” he says. “Intervention services [staff] look at things by the job.”

The only thing which everybody sees in the same way is the “safety component,” he said.

Hitachi also helped train Key’s staff. “If they left tomorrow we can stand on our own feet,” he said.

The master data is very important. “I need to be able to manage data by district, by asset, by employee,” he said.

“I can see a day when we might use [master data directly] in investor relations presentations.”

One of Mr Hood’s goals, he says, is to encourage district managers to make more use of the system. “Now some of them say, ‘I go in here every day’. It is very gratifying. It used to be that they were being bombarded by lots of different things, such as Excel spreadsheets. Now they have it all on the dashboard.”

Transocean business intelligence

Transocean, one of the world’s largest operators of drilling rigs, recently embarked on a large business intelligence project, upgrading its human resources and financial software (PeopleSoft), and getting a new supply chain product, says Sanjay Barai, director IT.

The systems developed were a hybrid of “out of the box” and custom tools.

The company has over 130 rigs moving around the world, with IT managed by a small team in Houston.

Senior management are most interested in knowing about the overall efficiency of the fleet. Asset management and maintenance is an important area. “We have custom apps on the rig that capture all the data for us,” he said.

“We wanted to get to 1 version of the truth – a single consolidated report, to monitor the health of the company.”

As soon as the business intelligent system was implemented, people started taking a lot of data sources much more seriously, he said.

The company assembled a team of ‘super users’ from different branches of the company, such as finance, supply chain and asset management, whose job was to provide input to the IT department. “It’s working very well for us,” he said.

Senior management can compare different divisions in the company, including the costs spent by each rig and the overhead.

The company keeps a lot of its master data in the PeopleSoft software (which can be used for human resource management, financial management, supply chain management and customer relationship management). It is pushed out to the system on demand.

That means the company has a single ‘source of truth’, he said.

You can get the answer to questions such as, how much advantage are we making of contracts, how much an e automate purchasing.

You can view data on mobile devices.

There are now plans to move the database for the system to Oracle’s Exadata.



Is your business managed around projects?

The work of oil companies is ultimately project based – explore here, drill there – so it makes sense to manage our work around projects, says Guy Barlow of Oracle

Most of us work with software tools designed for our specific work process, such as examining seismic, designing plant, managing maintenance.

But fundamentally the oil and gas industry organises its work around projects (build a production platform here, decommission there). All of these projects have a complex lifecycle, from selecting which project to go for, planning, deciding which ones to push forward with or cut back on as plans change, co-ordinating with all the companies involved.

How good are oil companies at managing their projects? The degree of maturity varies, says Guy Barlow, director, Industry Strategy at Oracle.

“Some companies use whiteboards, or don’t have a rigorous or programmatic approach to their projects”, he says.

“Often the connection between projects and the wider business impact is tenuous at best. Improving this connection take a rigorous standardized process and technology platform at both the project and broader business levels. Does a CFO really know which are his highest risk projects? Or the cash flow projections?”

Companies generally know what oil price various projects will be profitable at, but they don’t know how profitable they will be, and they don’t immediately know which projects they should be looking to pull forward or push back if the opportunity arises.

“We’re pushing the idea of projects driving your business,” he says.

“Being able to execute projects in oil and gas is a business critical skill. That’s what we help companies do.”

Companies put too much focus on their ERP data, which records the daily transactions and financial information, but falls short with day-to-day project management and how project trends impact the enterprise over the long term, he says.

Primavera

Oracle’s “Primavera” software suite helps companies manage projects across the enterprise. This includes the upfront capital planning solutions, “Portfolio Management”, to manage your entire portfolio – capital construction, turnarounds and daily maintenance — and the P6 tool, which can be used to manage, monitor and control all those types of projects. Including managing resources, scheduling, and engineering contractors



Helping you manage your business by projects - Guy Barlow, director industry strategy at Oracle

project execution, keep projects on budget and schedule.

“The Primavera software could be used as people’s daily “hub” software for planning, pulling data from a range of different systems, such as SAP and Oracle including ERP systems, maintenance management systems and human resource systems”, he says.

Saipem, BP, CNOOC,

Oil and gas engineering construction contractor Saipem recently announced that it was commissioning consultancy Accenture to put together a data management solution based on Primavera P6 for its onshore construction projects around the world, including planning, monitoring and managing projects in 35 countries.

Saipem will use the system to estimate construction work volumes and requirements, remotely plan activities, and track progress. A prototype phase to be finished in the third quarter of 2011, before being rolled out internationally.

“Oil and gas projects are becoming increasingly complex and are located in evermore remote locations,” says Marco Montesano, head of Engineering and Construction Management Information Systems, Saipem.

“Accenture’s bespoke solution will help us integrate data between distant locations, helping reduce the cost, risks and time associated with construction projects.”

BP America also uses Primavera for planning projects for its oil refineries. BP estimates that cost savings of \$3.5m are achieved from using it. It can manage maintenance and construction project data, and share this with contractors.

The system is also used by Offshore Oil Engineering of Beijing, a company which is

(EPCs) at a field level and reporting back KPIs, metrics and analytical information at the executive level.

The software is used to choose which projects to go for, evaluate risks and rewards, determine resources needed, manage

an affiliate of China National Offshore Oil Corporation (CNOOC).

Tracking changes

An important function of the software suite is keeping track of changes in the field with contractors and making sure everybody is aware of the changes, their impact and the course of resolution.

“Research shows that 40 to 60 per cent of cost overruns are because of inefficient change management,” Mr Barlow says.

The critical thing is to get communications out of people’s inboxes, off or spreadsheets and onto a central system which more people can access to more efficiently manage the change process, he says.

Improving work efficiency

The software can be used for planning big jobs, such as turnarounds, when the entire plant is shut down for maintenance work and then brought up again.

A single turnaround can cost \$100m. “The more efficiently you can do it the better,” he says. You’ll get a revenue generating asset back online and also reduce costs.

The Primavera software can be used to ensure the most efficient use of materials and time in turn improving project cash flow.

Studies have shown that the average ‘wrench’ or ‘tool time’ per shift, that is when staff are actually working with tools, can be as little as 2.5 hours.

Co-ordination

The software can also be used for co-ordination between companies. For example one company on the North Slope of Alaska was working with 3 different service companies, each responsible for critical elements in rig construction. And they were all working for separate schedules. “Simply put, they weren’t talking to each other,” Mr Barlow says.

Now they use Primavera to co-ordinate everything,” he said. As a result of using the solution, “our client could pull forward the oil 1 year earlier.”

The software enabled the much needed interaction between procurement, fabrication and construction. That means faster time to first oil and earlier revenue recognition.

Contractors are able to access the system over the internet. Everything can be managed via web browser or smart phone.



Control room thinking for offshore safety

One way to maintain the safety and reliability of a system is to have teams in charge of it, said Dr Emery Roe of the Centre for Catastrophic Risk Management, University of California, Berkeley.



Advocating a "control room" type thinking for offshore safety - Dr Emery Roe of Berkeley

One way to maintain the safety and reliability of a system is to have teams in charge of it, said Dr Emery Roe of the Centre for Catastrophic Risk Management, University of California, Berkeley.

More precisely, to have control room personnel with a legal mandate to keep the system running safely and reliably, who are continually monitoring the system, with the expertise and capability to fix problems in real time and try to keep everything as far from risk as possible,

He was speaking at the "Integrated Operations" conference in Trondheim, Norway, on September 13-14, organised by the Trondheim Center for Integrated Operations in the Petroleum Industry.

This system could be defined as 'high reliability management'.

This is the approach that has been taken by California Independent System Operator (CAISO), in its task of balancing the transmission grid's supply and demand of electricity, and avoiding blackouts, such as the ones in California during 2000 to 2001. The same approach has been followed by many critical infrastructures in the past, ranging from telecoms to oil and gas exploration.

These control room staff develop the skills of recognizing patterns, formulating action scenarios and understanding the threat level they are under, so they can work out the best way to keep things safe.

"They are looking at system patterns, constantly adding and updating information," he said. "They undertake a sophisticated form of risk appraisal."

A set of real-time indicators were developed for CAISO control room operators to keep track of the resilience of the system, or in other words it knows when and how far the control room staff went out of their comfort zones.

You can track the number of times

things get close to going wrong, how long the problems occur and how often.

It should not be surprising to hear that the resilience is lowest (or staff are most out of their comfort zone) in times of change, particularly times of unpredictable weather, and times when new software systems are introduced.

Managing supply and demand of California electricity is more difficult in April-May and September-October, where the weather can be less predictable, which means it is harder to forecast how much electricity people will need and when to repair equipment in light of summer usage.

"In 2006 there was a new piece of software which introduced much uncertainty," he said. "We know that hardware and software improvements can challenge the reliability of the service in ways you may not recognise."

Dr Roe sees many parallels between how reliability of electricity supply is managed in California, and how the oil and gas industry could manage reliability of offshore operations.

At Macondo, many things went wrong at once. How many of those things had gone wrong individually in previous drilling projects (blow out preventer didn't close, staff thought cement had set and it hadn't, rig control systems not performing as expected) and was information about those shared as widely as it should have been?

In other words, how often were drilling staff around the world going out of their comfort zone for various reasons? Was anyone keeping track of the frequency of 'saves', and the reasons, and so the overall system resilience?

The number of times control operators, such as drillers, go out of their comfort zone could be an important indication that standards are starting to slip and more care is needed, he said.

The Macondo investigations demonstrate the way that safety standards had drifted over time without anyone noticing, like a frog in slowly heating water. "What was wrong becomes acceptable," he said.

A little reported fact is that shortly before the Macondo disaster, the well's designation was changed from an exploration well to a production well, which means "a whole new protocol came into place," he said.

Could this change have been a contributing factor to the loss of overall system resilience?

After any big changes, "You know you're risking reliability unless there's been maximum pre-training," he said.

Management vs control room

It is not uncommon for senior management of a company to view control room staff as both subordinate and reluctant, the people who resist management's more risky ideas to improve the business.

People talk about 'management of change' like it is a task for lieutenants of senior management to compel all staff into changing the way they do things. But in fact, "change" can be one of the biggest causes of reduced safety.

When senior management want to introduce a higher risk strategy for business reasons, they may well have an agenda completely at odds with what control rooms across the world have learned promotes and ensure high reliability in real time services.

"The evolutionary advantage of control rooms is to reduce the risk of failure in order to ensure the safe and continuous provision of the infrastructure service. They would never increase the risk of failure to increase the change of success. From a control room setting, the CEO who says we must risk failure is like someone who risks suicide for fear of death.

"If the CEO and other executives don't understand the demands imposed by having a control room on organizational performance they certainly risk business failure."

Companies often dismiss these unique organization demands imposed on businesses whose brand is the reliability of their service. "After years of research, I'm here to tell you that control rooms are a unique organizational formation," he said.

"You can't ignore them any more than you can ignore a law or government regulation for reliability that affects the business brand of being reliable."

One 'moral hazard' with control rooms is that the safer they are, the greater the temptation of senior executives and their staff to take risks. "Every second they are reliable is one more second when a designer will take a wacky decision of how to make it better," he said.

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London, 04 Dec 2012

Measurables better than probabilities for risk

Risk of offshore operations is better looked at in terms of direct measurables – do we have a barrier or not – rather than probabilities, says Dr Robin Pitblado, director for HSE Risk Management Services at DNV



DNV's Dr Robin Pitblado

Dr Robin Pitblado, director for HSE Risk Management Services for risk management consultancy DNV Energy said that during operations it is not very helpful to look at a risk

in terms of a probability, but better to look at it in terms of direct measurables – whether or not a barrier is failed or degraded, and how to make sure that the barrier doesn't fail.

"Knowledge of the status of barriers is the key," he said. "In order to have an incident, several of your barriers must have failed."

He was speaking at the "Integrated Operations" conference in Trondheim, Norway, on September 13-14, organised by the Trondheim Center for Integrated Operations in the Petroleum Industry.

DNV performed many of the "HA-ZOP's" (hazard and operability studies) of all the processes which took place after the Macondo disaster, including flares, vessels and risers. This was to ensure safety for the response teams and to ensure no action made things worse.

One approach is to continually monitor the overall risk in terms of barrier status. So for example if a control system barrier has a problem, you can examine if the overall risk of the system goes up or stays the same – and respond accordingly.

You can make rules of what operations are "permitted" – i.e. allowed to occur – in the event of certain barriers being degraded. For example, you can determine whether or not it should be allowed to move a deepwater rig if the GPS is not available.

Dr Pitblado said that there needs to be more focus on process safety, not just occupational safety.

The oil and gas industry overall has improved occupational safety by 6-10 times over the last 20 years, but there has not been the same improvement in process safety. "Neither the EU nor the USA have been able to reduce major accidents," he said.

The key findings of the different studies into Deepwater Horizon / Macondo disaster were that "the accident was preventable, mistakes were made," he said. BP, in its investigation, identified 8 barriers that failed, any one of which should have prevented the scale of event.

DNV was commissioned to do the forensic investigation of the blowout preventer. While DNV cannot speculate beyond the report for legal reasons, this study showed that it failed to close because the high pressure, high volume production fluids going through the middle of the BOP at the time pushed the drill pipe (inside the BOP) to the side, where the knife could not cut it, he said.

One exception is the UK North Sea, where "major leaks have reduced from around 19 per year in 1996 to about 2 now," he said.

DNV believes that the industry worldwide can improve major accident safety "by a factor of 10, or in the North Sea by a factor of 3," he said.

DNV does consulting work helping companies improve process safety, by looking at the consequences of different process safety disasters, the different barriers, how the barriers are being monitored, human performance, and how often various events happen.

Integrated Operations can help, by making it easier to introduce new shore based specialists. If the offshore team is more confident than they should be given the current risk situation, the "shore-based people should not have that mindset," he said. "They can ensure corporate safety standards are not weakened by local pressures – financial, personal KPI's, etc."

Onshore staff can also verify that procedures are being followed fully and correctly, activity is within the permitted envelope, and barriers are functional.

However nobody has yet worked out how to utilize an integrated operations centre which could work in an emergency situation, but in any case, "in the last 10 minutes [before an explosion] maybe IO is not the way to solve the problems," he said. "Many problems develop in the weeks leading up to an incident and IO would be very helpful for these." Crisis centers after an event are well established.

On the question of whether the oil and gas industry is more complex than other in-

dustries, Dr Pitblado said that the oil and gas industry can be simpler in some ways, in that it is easier to understand whether or not you have a problem.

"If our safety systems work we can reduce the likelihood and amount of the leak or mitigate it after release. In the Texas City accident, there was material going into a column and no material coming out where it should, so it was going somewhere else and that led to the large release" he said.

"Other industries have more complexities and things you don't know and greater 3rd party interference. For example, consider the railway industry, with problems with trespassers on the track and many other things you don't know or control."



IO Centre and the IO conference

Arild Nystad, board director of the Trondheim Integrated Operations Centre in Norway and chair of the conference, said he would like the conference to become a breeding place for innovation. "The industry needs that," he says.

The event works as a flagship for the activities of the IO Center, he said. Next year, the event will be expanded to cover drilling and facilities.

The centre has relationships with Petrobras, with 8 managers from the company coming to the conference to learn about developments with integrated technologies. Saudi Aramco is on the IO conference advisory board. There are also delegates from Petronas. The partners to the IO Center are Statoil, ConocoPhillips, Petrobras, Total, BP, Shell, GDF Suez, eni norge, SKF, Aker Solutions, Kongsberg, DNV, IBM, FMC Technologies. Together, they are paying NOK 30m (\$5.3m) a year for 3 years, with a further NOK 10m per year funding from the Norwegian Research Council. All of the money is spent on research.

The center has 80 researchers including 15 PhD students. All of the research is done together with companies. There are teams going out to work with Petrobras four times a year, Mr Nystad says.

"People say IO has been there many years. But we are just in the middle of implementation phase 1. It is still an important business transformation going on."

What are your capabilities?

Most oil and gas industry companies define what they do by their products. But they would be better off defining what they do by their capabilities (ie what they can do which people will pay a premium for), and their relationships, says Professor Venkat Venkatraman of Boston University School of Management



Do you think of what your company does in terms of your capabilities or products, asks Professor Venkat Venkatraman of Boston University

In 2002, the most important capabilities in the mainstream IT industry were consulting, applications, tools, operating systems, networking, peripherals, computers and processors.

In 2002, Microsoft had a dominant position in many of these sectors, and close relationships with

companies in other sectors, such as with Intel, Dell and Accenture.

Today, the most important capabilities in the mainstream IT industry are social, mobile, search, browser, applications, operating systems and hardware.

You probably have an opinion about whether Microsoft has a dominant position in these sectors, or if it is playing catch-up.

The purpose of this example is to demonstrate that the most important capabilities in an industry can change, and nobody should feel comfortable that just because their capabilities are in demand today, they will be in demand tomorrow, said Professor Venkat Venkatraman of Boston University School of Management.

He was speaking at the Trondheim 'Integrated Operations' conference on Sept 13-14, organised by the Trondheim Integrated Operations Center, Norway.

The most important capability in the oil and gas industry's past was probably scale (size). But already today things are less clear-cut.

In future, we could see a different stack of important capabilities in the industry. It could include access to capital (or relationships with banks); economies of expertise (being large enough to offer many different opportunities to learn); being able to analyse data; managing a supply chain; and providing a range of staff support services.

"As I look at your industry, I see a huge potential for many capabilities," Professor Venkatraman said. "We can look at the digital oilfield companies of the future as a set

of capabilities driven by digitization and connectivity to create and capture new value."

Many companies still define what they do by their products and processes not their capabilities, he said. "Products are easy to see, capability and relationships are invisible. But they make tomorrow's organisation. Companies have to think, what do they really do which is so critical that they are needed in the ecosystem," he said.

Many people in the oil industry might think that digital technology won't change the central essence of how their business works. Just like people in the music, publishing, retailing, media, telecom industries once did.

Companies should also be wary of categorizing themselves as either suppliers or operators, because this can change too. "Historically we had supply and demand companies. But is Amazon on the supply or demand side? If IBM says, we'll work with companies to deliver a smarter planet solution are they on the supply side or demand side?"

A "capability" could be defined as the way a company deploys people, process and technology tools as well as how these are governed together, he said, so they end up with something people are willing to pay extra for.

"To me, capabilities are only interesting if the company doing it is at a sufficient level to earn a premium," Mr Venkat said. "Capabilities are not products or functions. It is the combination of ability (what we can do) and capacity (how much we can do it)."

Shell and Statoil

Professor Venkatraman is helping companies participating in the Trondheim Integrated Operations Centre, Norway, to work out what their most important capabilities are, today and tomorrow. Participant companies include Statoil, ConocoPhillips, Petrobras, Total, Shell, GDF Suez, ENI, SKF, Aker Solutions, Kongsberg, IBM, DNV and FMC Technologies.

Shell is working together with the Integrated Operations centre to develop the 'capability' approach and will pilot this approach in the Ormen Lange field for one of the capabilities.

Leo de Best, Smart Fields Global Programme Manager at Shell, said that Shell's Smart Fields™ roll-out is 'capability'-cen-

tered.

Shell wants to upgrade the entire way the asset operations work, so that people can manage the fields by exception-based surveillance, only looking at the data when the monitoring systems tell them that something new is happening.

"Often the implementation of technology is the easier path, but to make a lasting change requires a lot of work, [including] to make people aware of a need for the data. It requires local champions. We call this capability development, not just a technology," he says.

"Smart fields is good business and we expect the pace (of implementation) to continue if not increase. All new fields will be smarter than today in ways we cannot currently imagine. Integration of people and technology will continue further."

"It will provide attractive opportunities to new staff. It will help boost the energy supply and help to attract high quality new staff. It is not people-process-technology, we say people-process-technology and organisation."

Ronald Knoppe, Shell Exploration & Production Smart Fields Global Capability Leader for Collaborative Work Environment (CWE) says that Shell has defined its capabilities as "sustainability, operate-ability, repeat ability, adopt ability, implement ability, continuous improvement ability."

"We think we try to manage our assets by a set of capabilities," he said. "We've identified the capabilities we think are required."

"A capability is not a technology or a work process. Capabilities are a combination of tools / technology, people, organisation."

Trond Lilleng, senior advisor integrated operations with Statoil, said he sees standardisation as an important capability of Statoil. "Statoil has worked intensively to try to develop a standardised operation model for the North Sea," he said.

When it comes to capabilities, "Often I hear people tell me what the perfect solution is," he said. "But they don't understand where we are."



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Improving Integrated Operations

Continuous monitoring of environmental and operational risk, making teams work, communications for facilitators, and complex supply chains – some of the topics covered at the Trondheim NTNU Integrated Operations conference in September



Marissa L Shuffler

Marissa L. Shuffler, a doctoral candidate in Psychology with the Institute for Simulation and Training at University of Central Florida, said that it is possible to work out better ways to make teams work, based on her research with the US army, US military, aviation and medical industries.

“We are focusing on teams because teams are becoming a prevalent way to operate,” she said. “The complex demands and tasks can’t be accomplished by single individuals. But teams don’t always work, there can be problems with trust and conflict. What we can do to make teams more effective? We know that the teams process is a determinant of effective outcomes.”

“Communication is absolutely critical. You need co-ordination, leadership, a shared mental model of what is going on. Trust is absolutely critical to team performance.”

“Leadership is a mechanism which facilitates some of the most critical processes. It’s a determinant of how well a team will work together. Leaders are responsible for influence and problem solving. Leaders ensure that the needs are being met.

“A good leader creates the environment for team performance, ensures that people know what they are supposed to be doing.”

“Leadership can create a psychologically safe environment, where people are safe speaking up when they see a problem”

Monitoring environmental risk

Mark Reed, senior research scientist with SINTEF looked at the idea of incorporating real time data about environmental risks into daily operations.

In one project, SINTEF considered a system which could monitor the cleanliness of produced water releases, or monitor water quality a certain distance away from the platform, and provide real time data to operators.

If we had inexpensive sensors capable of measuring concentrations of individual components, you could do all of this in real time and wouldn’t have to model.

You could look at the accumulation of drill muds and cuttings on the seafloor (in kg/m²).

SINTEF also has a big project with ocean space surveillance, to monitor the environment from space.

Det Norske

Anita Utseth, chief of staff with Norwegian oil company Det Norske, talked about the company’s efforts to identify major accident risk indicators. The company wanted to work out how it could use its existing data to reduce accident risk, and not add to anyone’s workload.



Anita Utseth

The company produces 1,600 boe/day, but it is also the second largest explorer on the Norwegian

Continental Shelf after Statoil, she said, with a stock market value of \$1bn.

It started monitoring the backlog of maintenance tasks and availability of safety critical spare parts.

The critical question is whether the right issues are being covered to give a realistic view of overall risk. “We cover some issues but far away from everything,” she said.

The company wants to measure competence, quality of planning, risk assessment, and maintenance management.

“We got information on issues that we knew little about,” she said.

The system is monitoring trends, not performance. “But the most important achievement is that we have raised awareness about what causes accident risk,” she said.

Complicated supply chains

Atle Knudsen, regional improvement manager for maintenance and modification projects with Aker Solutions, talked about how to make a complex supply chain work.

Aker Solutions has 17,000 employees and 4,600 contract staff, doing engineering projects. It provides ‘product solutions’ including mooring systems, process systems, field life systems, maintenance modification

and operations, well intervention services.

Usually when working out how everything fits together, oil companies draw a map with themselves at the centre. But a contractor also has their own interfaces with their subcontractors. “In some fields, the subcontractors should be directly connected to the client,” he said. “For us to perform we have to put ourselves in the centre.”

“On one project I control more than 100 interfaces that we are dealing with, with in companies and within ourselves.”

“Information is the key to integrated planning,” he said. “We’re very focused on making sure communication is taken care of.”

Mr Knudsen says he has been doing conferences via web conferencing, where he speaks to 40 people at once, half in and half in Mumbai. “Their faces are small black dots [on the screen] – it doesn’t allow any communication,” he said.

Facilitators

Kristin Halvorsen, a Phd student in interpersonal communication and applied linguistics at NTNU, talked about the way people use language to get the right results, particularly in ‘facilitation’, or helping other people work together to get the results they are looking for.

“Organisations are talked into being,” she said.



Kristin Halvorsen

Ms Halvorsen used the example of an onshore team doing a teleconference with 6 offshore control rooms, to help everyone understand what is going on.

“Onshore you have the engineers, facilitators, technicians. Offshore you have the constant shift changes.”

“The facilitator role is more of an information broker- does not have formal decision rights.”

“Is it possible to be a facilitator if you don’t have formal authority? I think we pay far too little attention to personal skills in practice,” she said.



Doing more with your bandwidth

UK consultancy ISN Solutions is helping oil and gas companies get a better understanding of how network bandwidth is being used, both within the office, between sites and over satellite – and how to work with corporate software reliably from an offshore platform

UK oil and gas IT consulting company ISN is helping oil and gas companies get more efficiency out of their network communications bandwidth, helping them run software applications over a satcom link, and letting geoscientists work on their models remotely.

ISN was founded in 1999 by a group of ex employees from Enterprise Oil. It serves a number of UK small to medium sized oil and gas companies, including Tullow Oil, Petroceltic, Afren, Premier Oil, Northern Petroleum and Summit Petroleum.

Most companies have no idea what their office and satellite bandwidth is being used for, says David Ellison, director of ISN Solutions. If your network suddenly seems to be going slowly, you may never discover it is because one of your colleagues is listening to a particularly bandwidth-hungry internet radio channel.

Just like a road network, the internet has traffic jams (bottlenecks) and roadworks (parts of the network being unavailable) – but unlike a road network, people have no idea where they are – they just notice that their overall performance is down, he says.

Normally, people only discover such problems when users complain. “That’s no way to run an IT operation,” he says.

There was one case of a person in an office in Nigeria who downloaded an update to his Garmin GPS and crippled the Internet connection for the entire office for a few hours, he says.

Meanwhile people are using many different devices which use up bandwidth, and they are taking them onto rigs and expecting to be able to use them.

There are a range of network analysis tools coming onto the market which can give you a much better understanding of what is going on.

ISN tested a range of network management systems, and chose TotalView One from a company based in Victoria, British Columbia, called PresiNet. ISN liked it so much it arranged to have exclusive UK distribution rights for the oil and gas industry. “We found it answered all our questions,” Mr Ellison says.

The tool can enable you to monitor all the network traffic around your local and wide area networks.

You can have misconfigured devices, which are continuously trying to gain access

to a server which doesn’t exist (because it has the wrong IP address setting).

You can use the tool to spot security threats, for example if there is a lot of network communications to your human resources system at 3am on a Sunday morning.

You can spot viruses and Trojans, which can be responsible for large amounts of data communications, without the user knowing.

The software aims to get a deeper understanding of what is actually communicated, not just tell how many data packets are going from A to B, as traditional “flow analyser” software does.

You can view latency (delays in data transfer) and jitter (variation in packet delay).

The PresiNet box plugs into the “replicated port” of a typical network switch, and the network switch sends a copy of all data to this port.

The same system can be used to monitor communications across a satellite communications link, so you can find out exactly how your very expensive and very limited satellite bandwidth is being used.

You can monitor data communications from a remote office in the same way.

Offshore access to applications

Many oil and gas companies are keen for their offshore staff to be able to work on corporate software tools, such as SAP, procurement systems, SharePoint (document management), Primavera (ERP systems), JD Edwards. The benefits of this are that you can have a single data centre for your entire company, and keep offshore infrastructure to a minimum.

To work on offshore software, data does not need so much bandwidth (data communications speed), but it does need to be reliable, otherwise the software sessions end up disconnecting, and the effect of latency needs to be minimised, or users become quickly frustrated.

To make this work reliably and smoothly, ISN recommends using Citrix tools for working with software remotely, together with a ND Satcom “Xwarp” system to manage the satcom link, making sure that the data connection is used to maximum extent. An Xwarp box is installed on both sides of the

satcom link (ie one box offshore, one box at the earth station).

The Xwarp solution uses data caching, reducing the overall data communication which needs to be made; compression and acceleration, leveraging existing Citrix technology. The end result delivers performance to the user which would be impossible over a normal satellite link.

It also makes sure that the space segment is used as thoroughly as possible, with data flowing continuously at the full bandwidth available.

The company has built a “proof of concept” for the system in the offices of satellite infrastructure company Arqiva, sending data over real satellite segment, and showing how the system compares to a more usual satellite communications set-up.

Remote geoscience systems

ISN is keen to help oil companies to enable their geophysicists and geologists to work on subsurface models remotely, so the company can keep all of its data in one central location, and the g+g staff can access data from other offices; work at home or even in airport lounges.

ISN has developed a system which can send the subsurface images as a compressed video file, which is higher resolution than YouTube, but only requires 2 Mbps data connection for some.

A 1Mbps connection is sufficient for light use such as peer review while a 4Mbps connection would be best suited to High Definition resolutions and multiple monitors. It provides a similar resolution to BBC iPlayer, which UK readers will know.

The Image Configuration tool gives the G&G user control over how smooth and how crisp the video appears in low bandwidth/high latency environments

All the graphics processing is done in the central computer centre, where you have a powerful graphics card assigned to each user, costing between £500 and £6000 each. The client computers don’t need a particularly powerful graphics card because they are just playing video.

From an IT managed point of view, by keeping data in one centralised location, you avoid a lot of security and administration headaches, with users having no need to copy data onto their own laptops or USB sticks.

E-commerce standards – and management

PIDX London conference report: how do you get senior executives interested in electronic commerce data standards? How do you explain how it is relevant to the business bottom line?

“Let me give you a hint about senior executives,” said Christina De Luca, VP procurement and supply chain management, BP. “They hate to feel really stupid, and talking about [e-commerce standards] really makes them feel stupid.”

She was speaking at the 2011 Autumn meeting of PIDX (Petroleum Industry Data Exchange), the oil and gas e-commerce standards body, in London on October 6, expressing her personal opinions of senior managers in general.

“They like adding value to a conversation. When they don’t understand what you’re talking about they can’t add anything, and often they choose not to engage.”

Data standards is a hard subject. “My mind glazes over. she said.

In order to get senior management interested in data standards, you need to be able to explain what value they get from them.

“If [you say], ‘we’re going to have good quality data’, I can’t take that to the board. Senior managers want to know, ‘What’s it got to do to my cash flow position?’ These are the decisions which allow business leaders to compare any investment. Unless standards bodies put the message in the language of business, it’s very hard.”

“Many firms struggle to make the business case, even just in their own firm.”

“Over my career I’ve moved from a very technical background to a business perspective. I’ve got knowledge of the field you

are experts in.”

“You need to help me articulate what the standard is all about. What would adoption of the standard mean? What are the implications to my firm? How will it impact my business? What value does it bring?”

“There’s a language that is used in this field that communicates to individuals in the field but doesn’t communicate to a business person.”

“We have to call everything the same thing. I understand [the benefits of doing that].

“The people [in PIDX] see the value proposition, and also see the beauty of it – a simplified way of communication. And there is value associated with the elimination of duplication.”

Ms de Luca also questioned how focused PIDX is on business need. “In PIDX there are 200 standards. It’s a lot of work and a lot of standards. Are we working on those items of standardisation that are of value to business?”

She challenged the PIDX Executive not to focus on problems that interest PIDX technical professionals, but to work on solving the problems that will create most value for our firms and the industry.

Ms de Luca is sceptical about whether PIDX had created a global standard, and if it isn’t, whether or not the effort will work.

“We have to recognise the fundamental shift that has occurred in the industry. Oil majors used to be the standard setters of the

industry, but they’re not today. It’s Chinese, Russian firms. More and more they are developing the capability to move out on their own. They will dominate the industry in years to come.”

“If I was dominating the industry I would expect to set the standards of the industry.”

And if Chinese or Russian companies were setting the standards, would they choose the same standards which PIDX has taken, or would they do it differently? “Chinese are more conservative than Western firms,” she said. “They have tremendous scale”.

BP’s master data

The subject of master data “tends to be fairly dry,” said Steve Mitchell, who looks after master data management in BP’s downstream procurement department.

“Data is particularly important in procurement, so you know what you buy and who you buy it from,” he said. “We find a lot of duplicates, when people are buying something more than once and not aware of it.”

But “master data management by itself doesn’t actually create any value. It’s like joining a gym; you have to start using it to get the benefits.”

BP initiated a master data management scheme for its Rotterdam refinery in 2007. Now the company has 47,000 vendors and 220,000 materials in its downstream master data.

One of the keys to master data is reducing the amount of data which is entered in ‘free text’ – the more drop down lists people use, the easier it is to organise the data they generate.

Nobody wants to select an item from a drop down list of thousands of items, so to make it easier, BP describes items with a noun + modifier. So if you want a gate valve, first you select ‘valve’ from a list of 850 nouns, then you select ‘gate’ from a list of 475 qualifiers. Similar for ‘air filter’, you select filter first, then air.

Items can have more attributes (for example size) which don’t all need to be entered into the form.

Staff often struggle with the idea that everybody in the company has to use the same language, he said. “This is the difficulty of getting the nomenclature right.”



An acquired taste.. is it possible to make the subject of master data management less dry?

It is increasingly important to look at the quality of the data. If it's low quality is not going to be used.

It is also important that people keep the data fields complete. Otherwise it's like if you have one record which said a person has a tattoo, and the other one doesn't have anything in the 'tattoo' field, you don't know if they are duplicates or not.

It is important to be aware that manufacturers can have two items with different sizes and the same part number, he said.

When it comes to convincing staff, the best way to do it is to keep track of the stock (inventory) which you no longer have to keep, and the purchasing you've avoided, as a result of the master data system, here is some real value, he said.

Mr Mitchell said that he tells suppliers that he expects them to provide high quality data. "But we don't normally get it," he said.

PIDX news

There are now 100 oil companies worldwide using PIDX, said Bill Le Sage, chairman of the PIDX board. One international oil company has now processed 6 billion dollars of spend through electronic invoices using the standard this year.

Another oil company managed to reduce its procurement department from 115 to 12 from using the standard, with personnel redeployed elsewhere.

PIDX has groups developing new standards for cataloguing, downstream, and regulatory reporting.

PIDX plans to develop a standard for service contracts. "80 per cent of spend in oil and gas is on services," said Paul Meyer, chairman of the PIDX Dictionary and Cataloguing committee. "But we've very inadequate in controlling the spend. Services are the elephant in the room."

PIDX also wants to measure adoption of the standard, said Dave Wallis, chair of the PIDX marketing committee. "We're in the process of developing metrics now."

The aim is to get to the point where people don't notice that they're using the standard, said Dave Wallis. Take for example the USB memory stick or the pdf standard. "You didn't notice it, everybody can use it," he said.

"Our ambition is to be global, we are trying to establish regional sub groups," said Anthony Aming, president of PIDX and enterprise business and applications architect with Baker Hughes. "We are looking for a PIDX volunteer to set up PIDX's Western hemisphere events."

PIDX had very recently made its first high level visit (4 PIDX Executives) to Bei-

jing and PIDX had been well received, with requests made for follow-up visits to further investigate PIDX standards, he said.

PIDX wants to develop partnerships with like-minded organisations such as Energistics, and develop a succession plan for its executive positions.

Since the re-launch in May 2011, there have been many new companies join, notably Statoil has joined as member, he said.

8over8 – contracts software

Northern Ireland company 8over8 is seeing a growing business selling software tools to help oil and gas companies manage their contracts, said Richie Anderson, product manager.

"Major capital projects are the lifeblood of the oil and gas industry," he said. "There are many stakeholders. There's always big pressure to deliver on time and budget."

Projects around the world are getting bigger and bigger, and the bigger the projects are, the bigger risk something can go wrong, and the bigger the impact if it goes wrong, he said.

"The mega projects are managed by geographically disparate teams. There's an increased regulatory burden around the world with requests for local and social content. There can be unstable geopolitical situations and a risk of natural disasters."

"Major capital projects, like Shell's floating LNG project in Australia, are larger, need extensive financing, have compressed project timescales and are technically more challenging," he said.

Oil majors can spend 90 per cent of their total capital expenditures in contracts, he said.

The average cost overrun of new rig projects has been estimated at 35 per cent, or 20-30 per cent for FPSO construction projects, he said.

Delays can have wider reaching consequences, such as damage to reputation and delays to other projects.

But at the same time, project managers can have a terrible time trying to understand what is going on. "It's not uncommon to have to put together a monthly report based on 450 spreadsheets," he said. "The nightmare scenario is when you get asked 'why have we received an invoice from a contractor'. The contractor says 'one of your field engineers hand wrote the instruction'. The project control department says, 'we don't have any contingency budget'."

8 over 8 provides the "PROCON" software tool to help manage contracts.

You can keep track of the contract variations, when a contractor asks to change the original terms of contract. You need people to know what has been agreed, and also keep track of how many times different contractors want to change the terms of their contract. Perhaps he is winning the contract by bidding with terms he can't deliver, and then changing the terms later.

PROCON provides an online tool which all suppliers can communicate through.

You can sort out the contract variations, so just view the variations which had a financial impact.

You can see how much you're agreed to pay and how much you've spent on a contract."

There is a 'contract performance dashboard', tracking the average time contractors take to respond to communications.



Tackling the tricky issues of getting e-commerce standards used in the oil and gas industry - 2011 Autumn meeting of PIDX (Petroleum Industry Data Exchange), the oil and gas e-commerce standards body, in London on October 6

Developments in oil and gas data and IT

Getting over the DOF obstacles

Why do DOF projects frequently get blocked by obstacles? By Dutch Holland

Imagine a typical upstream business operation that has operated smoothly until one major piece of equipment breaks. An obstacle.

Imagine that same business operation losing a key employee to a competitor. Another obstacle.

US government department BOEMRE issues another new regulation that directly impacts upstream operations. A big obstacle.

But imagine that same upstream business decides to implement an IT application ("SpeedAP") to speed up management decision-making.

A few months later, the business unit leader asks the implementation project manager how the implementation is going and hears: "Nowhere. There are obstacles everywhere. We are shut down."

The surprised business unit leader asks for examples of obstacles that have shut down the implementation.

"First, the people are using Excel spreadsheets and are comfortable with that. Another obstacle, the 'SpeedAP' software is not even reachable from engineers' desktops. And I could go on. The last asset manager I talked to about the implementation said she didn't even know anything about an IT implementation."

Obstacle based thinking



Obstacle-based thinking in a change process labels every needed change step as an obstacle, with somebody or something being the hindrance to progress.

Imagine hiring a contractor for a kitchen renovation.

In the first progress meeting with the contractor, he says he is shut down because of many obstacles.

Obstacle: the new sink cannot be installed because the old sink is still in place.

Obstacle: the new stove cannot be installed because the electrical power line in

the kitchen doesn't carry the amps or voltage needed by the new stove.

Obstacle: the lovely new picture window cannot be installed over the work area because there is a wall there.

Any thoughts about what to do or say to that kitchen renovation contractor?

Design-based Thinking

An alternative to obstacle-based thinking is design-based thinking that focuses on action steps needed to reach a goal or a result.

Design-based thinking identifies which changes must be made to the machinery inside an organization in order to gain value from improved business processes enabled by digital technology.

Action: Remove the old sink to make room for the new sink

Action: Install new, high-power electrical line to kitchen to be used to power the new stove

Action: Break through the kitchen wall to begin installing the kitchen window

Where does design-based thinking come from?

Certainly it can come from pure logic if the need is for a simple kitchen renovation. For a more comprehensive and complex renovation, the body of knowledge around renovation engineering and construction can provide best practices as well as "lessons learned" from successful renovations.

The source of design-based thinking for implementing DOF technologies to enable operations processes to generate more business value comes from several bodies of knowledge, such as technology insertions/deployments, technology transfer, diffusion of innovation and transformation/change management. Also lessons from failed or underperforming technology implementations.

Obstacles to design parameters

Issue: A frustration that many products being sold do not meet user requirements

Design based thinking: Is it possible to say that products which do not meet user requirements are being sold (and therefore bought)? Vendors frequently say that they cannot get precision requirements from their buyers that the vendor needs to meet an operator's user requirements.

Issues: More products using WITSML (a standard system for drilling data) and a slow but sure move toward cloud technolo-

gies.

The design-based action step for operators is to strengthen their "watch capabilities" for detecting and assessing advances in technology, development of standards and evolving best practices in security.

Issue: Operators' frustration about lack of progress

Operator frustration depends on the organizational function and level of the frustrated. Without an organization-wide proactive approach to design and implementation, DOF progress is likely to be elusive and remain "just fine for some" and "hugely frustrating" for others.

Obstacle approach

Technologists in operating companies continue to listen to concerns of operations and other IT users in their organization. They continue to shop for DOF technology that "looks interesting and must be useful" and, of course, they shop everywhere but buy the big name vendors (how could that be criticized?).

Obstacles to DOF are noted as they occur and are reported. Technology vendors are encouraged or allowed to propose technology solutions as the primary means of defeating or going around the reported obstacles.

In order to defeat the obstacles, technologists can go back to the "Bank" (top operating company executives) and get even more money.

Design based approach

Operators get clear upfront on what business value results they need from the operations side of the business. Operations managers, working with technologists, identify the most desirable business improvement opportunities along with the enabling digital technologies.

After positively assessing the power of DOF, the business case for operations improvements through digital technology is made and approved at the highest organizational levels.

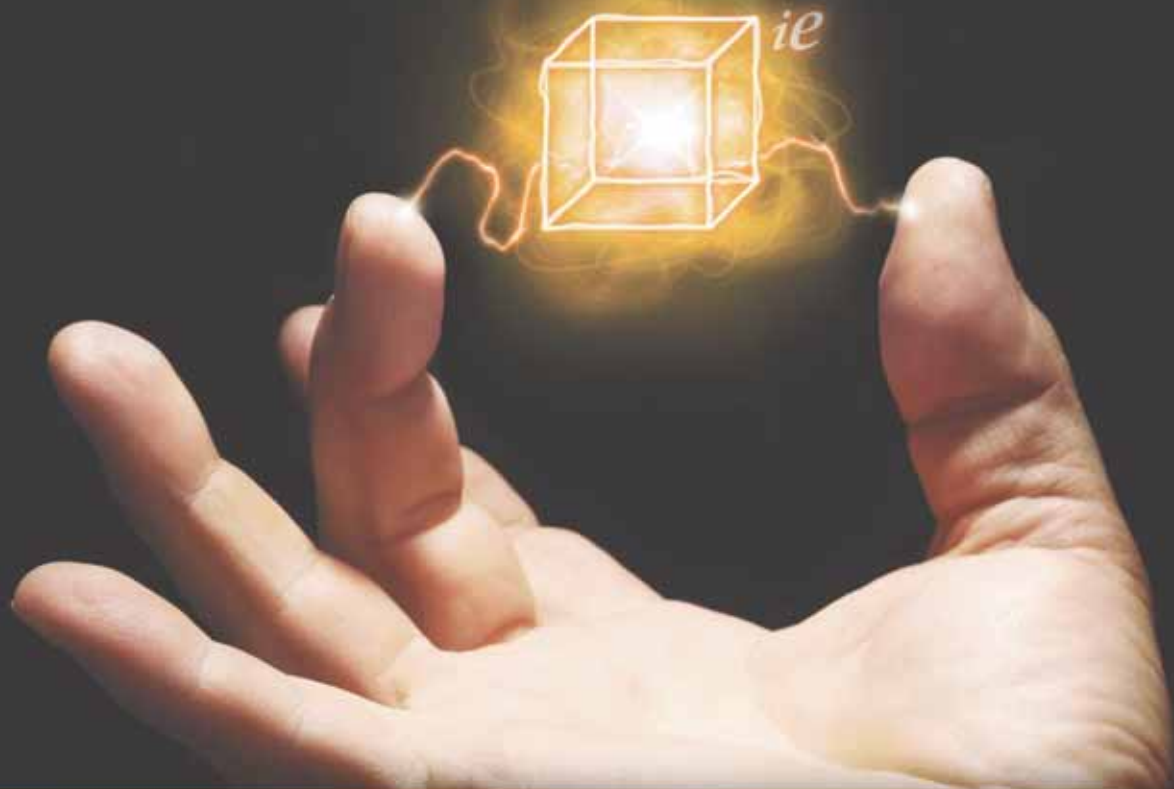
After learning from other industries that have experienced multiple waves of technology innovation and implementation, top management puts DOF business value architecture in place to achieve business goals.

Operators engage the immediate competence to jump-start technology importation as they begin to build the necessary competencies inside.



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TRANSFORMATION – TIME FOR DECISIVE ACTION



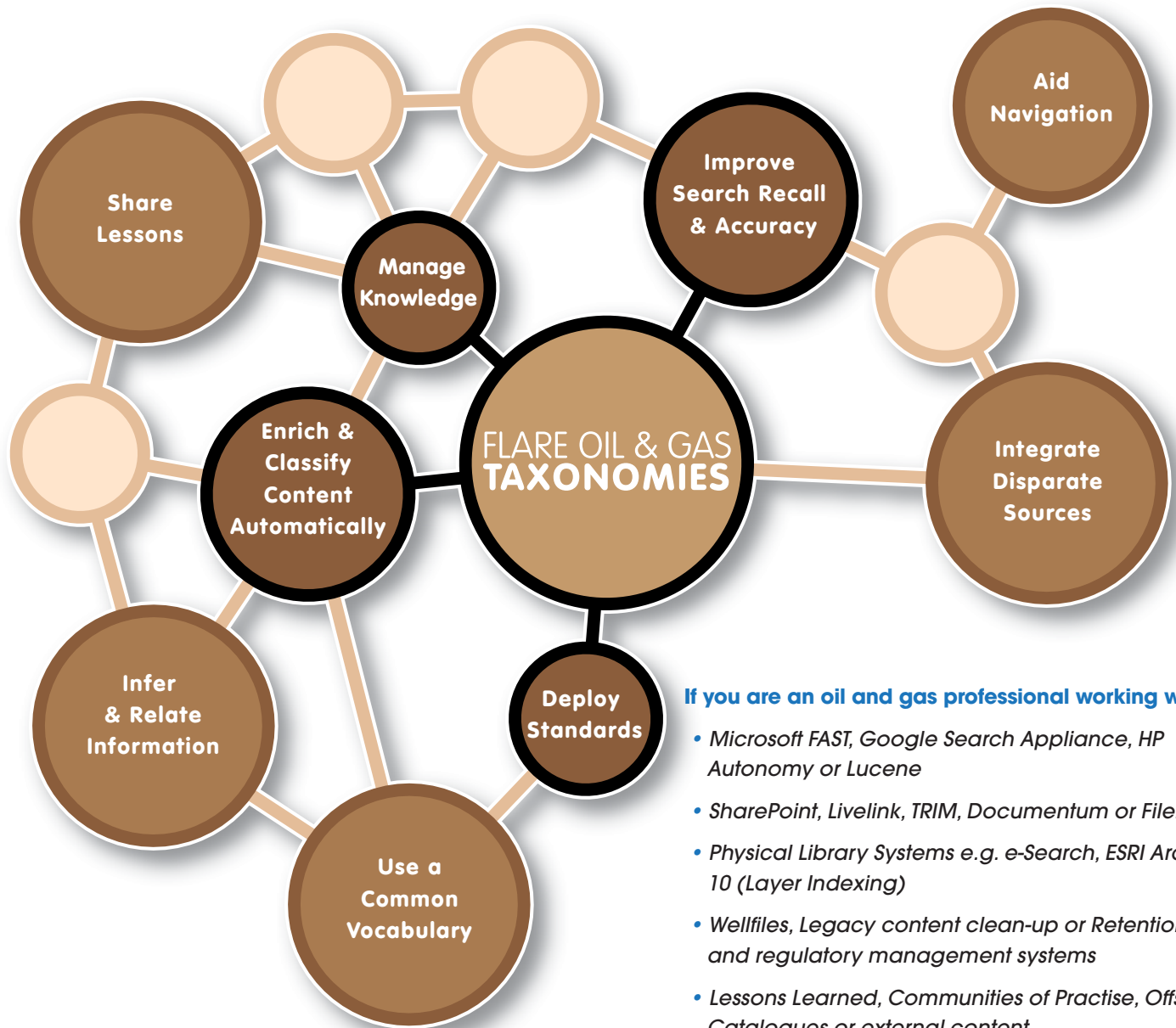
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