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Intelligent Energy 2014 report

When Digital Engineering is business as usual

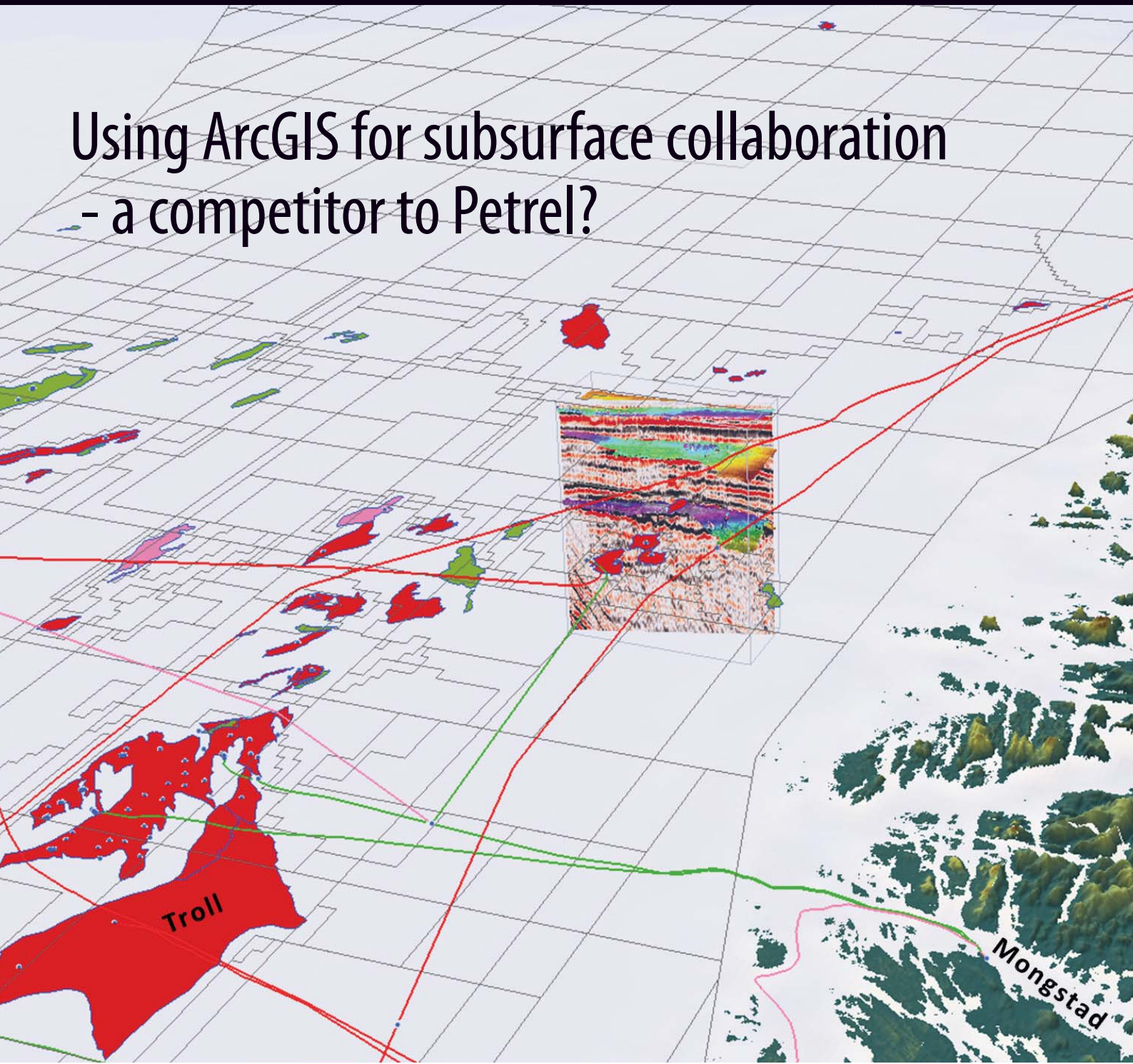
Avoiding common data governance problems

A petrophysics driven well data workflow

Improving security of drilling data

June/July 2014 Issue 49

Using ArcGIS for subsurface collaboration - a competitor to Petrel?



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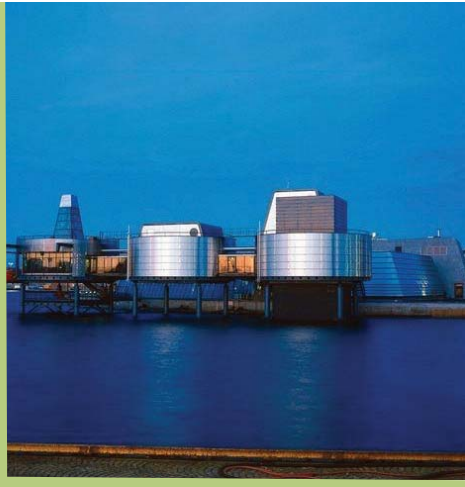

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Aberdeen, 23 Sept 2014

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Doing more with subsurface data
Kuala Lumpur, 13 Oct 2014

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digital energy journal

Issue 49 June - July 2014

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Now it is possible to manipulate 3D data using Geographical Information Systems (GIS) such as ESRI's ArcGIS, systems like these might be an alternative to traditional subsurface applications for working with subsurface data. See page 6.

Printed by Printo, spol. s r.o., 708 00 Ostrava-Poruba, Czech Republic. www.printo.cz

What is Intelligent Energy now?

There might have been a reduction in buzz at this year's Society of Petroleum Engineers (SPE) "Intelligent Energy" event in Utrecht this April compared to previous years – but replaced by an increase in intensity.

Maybe we are getting less excited by digital technology these days – we know it can cause trouble as well as benefits - but we are getting a much clearer idea about where we want to go with it.

There are many strands to digital technology in the oil and gas industry, all with a strong sense of direction. Downhole controls, well monitoring, production and operations advisory systems, understanding the reservoir, drilling automation, collaborative work environments, analytics, cyber security, remote operations.

We are standardising data, improving visualisations, understanding data flows better and improving tools which give us better oversight. We are also getting to grips with the necessary psychology, organisational understanding and change management.

Soon digital energy will become "business as usual'. On page 17 of this issue, Dutch Holland and Jim Crompton imagine what this might be like.

But there's some way to go. One Intelligent Energy session included an audience show of hands asking whether the industry has 'crossed the chasm' with the new technology (as described in Geoffrey Moore's famous 1991 book on technology implementation) - and around 55 per cent said no.

A highlight of this year's Intelligent Energy event was a plenary session talk by Pieter Kapteijn, a former director of corporate technology and innovation with Maersk Oil, and conference committee chairman of the first Intelligent Energy conference in 2006.

"When we started [with Intelligent Energy] we didn't know where we are going," he said. "When we arrived we don't know where we are."

Sometimes the oil and gas industry has a "fear of complexity", Mr Kapteijn said.

Oil and gas executives can be perhaps too keen to simplify, saying 'please capture it in three slides', he said. But there is also a risk of oversimplifying.

"The industry is complex, but it is not difficult," he said.

The industry is also perhaps too keen to chop problems up into small processes, rather than take a systematic view, he said.

An example of the penalties of this approach is Germany's approach to cutting carbon emissions, he said. Germany built more wind power than any other country, yet saw its greenhouse gas emissions go up due to increase in coal consumption. "My view is that the big picture has been neglected," he said.

Digital Energy Journal has closely followed all of the biannual Intelligent Energy events since 2006 – our first issue also formed the program for the first event in 2006, and we have reported on all of the 5 events in depth. In this issue you can read our report from the 2014 event.

Karl Jeffery, editor
Digital Energy Journal, London

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INTELLIGENT PETROLEUM FIELDS AND INTEGRATED OPERATIONS

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CRISTINA PINHO
Executive Manager, Petrobras

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DAY 1

PLENARY 1:
Intelligent Petroleum Fields and future technology challenges in O&G

PLENARY 2:
Proactive Operations in O&G

PLENARY 3:
R&D and Innovation – Business & Academy

DAY 2

PLENARY 4:
The value and challenges of implementing Integrated Operations

PLENARY 5:
Autonomous systems and remote operations

PLENARY 6:
Integrated Operations in the future. Round table discussion

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Petrophysics data in Dong Energy Norway

Roberta Radice, senior petrophysicist with Dong Energy in Stavanger, explained how Dong manages the workflow for petrophysics data in exploration projects, and ensures data is always easy to find

Explaining Dong's structured workflow for well data work - Roberta Radice, senior petrophysicist, Dong Energy

Dong Energy Norway has a structured process for managing and interpreting well data in exploration projects, which ensures that geophysicists can always get the petrophysics interpretations of well data they need, and it is always easy to find in future, said Roberta Radice, senior petrophysicist with Dong Energy in Stavanger.

She was speaking at the Digital Energy Journal conference in Stavanger on May 6, "Doing more with Subsurface Data".

The process starts when a geoscientist fills out a data management service request on the internal web portal, to say they need a petrophysicist to do work on a certain well log.

The request is sent to the E&P application data management group, who then forward it onto the petrophysicist in charge of the area.

The petrophysicist discusses the objectives, criticalities and deadlines of the work with the geoscientist.

Petrophysics tasks might include doing computer processed interpretations (CPI), putting together composite logs (made of measurements and interpretations from many sources of data).

Composite logs can be done in an hour, but full CPIs can take between 1 and 4 days.

Other work might include fluid substitution calculations, to remove the effect of drilling fluid from the logs taken during drilling. "There are some other non-routine types of work," she said.

Once done, the work is passed onto the data management staff, who do some basic checks on it. The data management staff will take this data and insert it into whatever geophysics software is being used, such as Schlumberger's Petrel or GeoFrame.

"Of course there is a need to communicate and to share objectives and timeline between the geophysicist and the petrophysicist, a continuous update in the two directions," she said.

There are no software tools to automatically manage the workflows and tasks, it is all done manually.

The workflows for petrophysical work on development and producing assets are different, but also standardised, she said.

Time line

The processes have a typical timeline which everybody understands, from requesting the data to receiving it.

A big factor in the time a project takes is how easy it is to find the data. "If the well is being looked at by other petrophysicists, we know how to find the data," she said.

If previous work has been done according to the standards, the well data will be much easier to find.

"If it is a completely new well to the company, the full process has to be run, and then doing composites, CPIS, and other things will take much longer."

Following the processes

It is important to try to avoid taking shortcuts with sharing data and knowledge, she said. For example, people are sometimes tempted to e-mail files to each other, because it is easier over the short term than uploading them to the right place on the system.

But if the data management processes are not followed, "in the end, data is lost," she said.

The data management staff do a tour of the company periodically to make sure all employees know about right procedures and processes, such as how to request data, and what the workflow and standards should be.

The company has an internal web portal where all the processes and procedures are stored in detail.

Data storage

The processed data is also stored as a file on the corporate network. Dong has a standard folder structure for this, with different subfolders for different countries, and subfolders within that for all wells. Then there is a standard group of folders for each well. Only one folder structure is allowed.

For Norwegian wells, the well folder structure is the same as the one used on the DISKOS shared data repository.

Once data is stored in this repository, all previous versions are kept - so if you save an update, you can still go back to the previous version.

The data can be accessed by everyone in the company who might need it, but only data management staff can add or remove files.

Dong stores project data and seismic data in the same way.

Company standards

The company has detailed procedures about how it will name wells, well curves, well header attributes, well picks and markers.

Dong has standards for how log curves should be displayed, what scale it will use, and whether they will go to the right or left. It has standard quality control checks, looking at the maximum and minimum of the curve.

The company is developing standard procedures for other processes, such as what to do when the company receives new well seismic data from Dong operated wells.

"What we're trying to do is keep standards for every piece of information that we use in petrophysics," she said. We want to "ensure that the data can be shared inside the company with no ambiguities."

Stratigraphy standards

There is an ongoing project to develop standards for stratigraphy (labels for rock layers) well picks and markers. This covers lithostratigraphy (rock layers over time) and biostratigraphy (fossils).

The idea is that the same stratigraphic naming convention can be used to identify rock layers across all disciplines and software packages, she said. "This is hard work, working on data

in a stratigraphic way," she said.

"When you have to share this data with geologists and petrophysics it can get a bit chaotic to understand what the stratigraphic level is."

It would be good to include this data in the subsurface software, so geologists using Petrel have the same stratigraphic markers as petrophysicists have in their software.

"The attempt is to create a procedure, so once the stratigraphic level is defined, it should go through a workflow or decision tree to make sure that the final version of the marker is stored properly," she said.

Ownership

The data management staff are asked to take ownership of the data. "We try to make sure he reference point for data flow and everything is data management (staff)," she said.

The data standards are enforced both by petrophysicists and data management staff. So for example petrophysicists need to choose the right naming and colour coding for their work, and data management staff manage the storing of the file itself. "It is a very integrated thing for me," she said.

"We are putting a big effort into making sure this is working."

Download videos and presentations from our Stavanger 'doing more with subsurface data' event at www.d-e-j.com/event/ee70c.aspx

How to achieve data governance

Many oil companies find their efforts to improve data quality are short lived – after a clean-up project, the data quality starts to downgrade. Ed Evans of NDB explained how to make your data management projects sustainable

Helping you make your data governance projects sustainable - Ed Evans, managing director of New Digital Business

Oil and gas companies often have problems sustaining data quality. They have a big project to clean up their data, but then after that it starts to degrade, said Ed Evans, co-founder and managing director of UK oil and gas data and software consultancy New Digital Business (NDB), speaking at the Digital Energy Journal Stavanger conference on May 6, "Doing more with Subsurface Data".

The end result is a lot more short term projects such as data clean-ups, but poorer long term results, he said.

Many companies are trying to tackle the problem and finding it harder than they expected. "A common approach in oil and gas today is to say, we don't want to keep redoing things, we want to make sure that when we do the work it persists," he said.

The key to getting it done is making sure people take responsibility for the data, and also making sure you have an organisational structure to support it, in particular with attention given to the relationship between the IT department and the rest of the business, he said.

The industry has had a clear idea for many years of what good data management looks like, he said.

The data has a definitive source, you know what data is available within the company, you know how to find more data is you need it outside the company, and you trust the data.

Oil and gas people are often very good at solving short term problems, but not very good at looking at long term solutions, because they are often moved onto different projects, he said.

Conversely, if oil and gas companies decide they want to take a long term view of data, the solutions will follow. One development team said, "the asset we are working on will exist much longer than any of us working on it. They took a determined look at data management from day one, to the extent of building that into their performance contracts."

Problems

It is still typical for oil companies to have data stored all over the world, raw data and interpreted data. No-one trusts it, no-one knows who is doing what with it, and no-one knows what the process is for bringing new data in, Mr Evans said.

The problem is getting harder because "there are more data types and there are less people to do the data work," he said.

"Success is patchy." In every company, "you've got a couple of geologists who don't manage their data."

At the end of the day, having incorrect data can lead to problems such as the company filing inaccurate figures for its reserves. "There's a responsibility on the CIO to make sure data used to make decisions is as accurate as can be," he said.

Data governance model

A good step towards permanent data governance is putting together a permanent team of staff to achieve it, and giving them the right support.

The company needs to decide how much budget is provided to data management, how the budget is spent, and what the work priority is. "Clearly we can't tackle everything at once," he said.

The data management staff can be asked to meet a certain service level, for example to upload new well data in two days or provide information on what data is available in a certain number of hours.

Data management should has a 'steering board' which decides on the overall direction and what the imperatives are, and then the leaders of each discipline (for example the head of petrophysics) decides on how data for that discipline is managed in the organisation and what software tools are used.

Putting in this sort of governance model also means that management is involved. "If data management was represented at this level, there's more authority, and assurance that whatever is decided gets done," he said.

"It embeds data management as a discipline within the organisation and provides the credibility to data management," he said.

Ownership

"One of the things that can hold all data management initiatives back is the concept of ownership," he said.

"People will sit around and will come reluctantly to data management meetings, but the idea that they do something about it and own the problem is quite difficult to get over."

The person who 'owns' the technical aspects of data management needs to be from that specific discipline - someone who can define the parameters of how something should be documented or described, and what range certain technical parameters should lie within.

IT and business

Often there are gaps between the IT department and the "business" (the rest of the company), he said.

It can be a mistake for the business to leave the IT department to implement the technology and then don't get involved any further, because many questions don't get answered very well.

"Somehow we need to overcome the resistance of the business in getting engaged with data," he said, "and stop the IT department thinking, we're going to do it all ourselves."

For example, the business department of one oil and gas company decided they wanted to upgrade Petrel software every six months and keep the last three versions of Petrel available, and left the IT department to get on with it.

"You can see some logic behind it," Mr Evans said. "But that's a lot of work to keep upgrading your technical system, with all the plugins and the integrated data. "Sometimes the implementation and maintainance [a system] has a much bigger impact on the business [than people expect]."

Sometimes the business will say to the IT department, "do what you want to do, so long as it doesn't impact the users," he said. But it is very difficult to get technology and systems implemented which don't impact the users.

Sometimes companies rely too much on technology purchases to improve data management. "You can have a fantastic set up and it still doesn't seem to be working," he said.

In one example, an oil and gas company spent a lot of money buying Schlumberger software, including Petrel and Eclipse.

"The IT people were very proud they rolled this out to the company within three months of deal being sorted out," he said. "But nobody can run it because they don't have the right hardware. And you still need to move the data [into the new software]."

"Nobody in the business thought, actually the value of implementing Petrel is not the fact you implemented it, but when you can do things better than you could with your previous software."

"That's a really complex conversation, working out how to implement software which helps us find oil and gas better and be more cost effective than before."

The cost of software can end up equivalent to the cost of drilling three or four wells, he said. "People say, give us the software we need, the costs aren't important. But actually the costs can be important, and the costs which go along with it."

IT managers are often conflicted between a desire to keep things as a steady as possible, and a desire to have the latest and greatest technology. "There's no easy answer to that, it is falling between the two stools," he said.

Oil and gas CIOs often believe their career success depends on their ability to implement new software, and they expect to be spending their careers implementing new software in different companies, not necessarily sticking to oil and gas.

"IT guys know what they need to do, but they get frustrated they can't engage with the business to get those things to happen," he said.

Audit your applications

Another way to make the task more manageable is to start by auditing your software applications, decide which ones you want to keep, and then how to best manage the data to serve them.

"We don't need to see the data and applications as big amorphous mass," he said.

For example you can make a list of all the software tools which are used for geophysics in the company.

You can present the list to the geophysics department and say, you decide which of these tools are important to you, and then the approach to managing data can follow from that.

Maturity measurement

There are ways to measure maturity of data management implementations, he said, although this doesn't necessarily tie directly to business results.

"In terms of pure data management, you can characterise organisations by how they organise their data management group, if they've got processes well defined."

"We've worked with a company that is able to compare data management maturity with finding costs or development costs.

Panel discussion at our 'Doing more with Subsurface Data' conference. From left to right: Morten Tønnessen - Managing director, Geocap; Ali Ramady - Geophysicist and territory sales manager, LMKR; Alexandre Bouche - Pre-sales Consultant, Roxar; and Ed Evans - Co-Founder and Managing Director, New Digital Business. Out of shot: Roberta Radice - Senior Petrophysicist, Dong Energy

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ArcGIS for subsurface data?

Could geographical information systems such as ESRI's ArcGIS prove a good way for a company to interpret, visualise and collaborate on subsurface data in 3D?

Just about every oil company uses Geographical Information Systems (GIS), typically the ArcGIS software from ESRI, to manage their geographical information in 2D maps, such as which areas they have seismic data for, and where their surface infrastructure is.

GIS systems could prove useful for subsurface collaboration, says Morten Tønnessen - Managing Director, Geocap.

And every oil company uses subsurface data management software, such as Schlumberger's Petrel, IHS's Kingdom suite or Landmark's software, to manage their subsurface data around the company and let people collaborate on it.

For the past few years, it has been possible to use ArcGIS for 3D models, as well as 2D maps – which means that you could also use ArcGIS for your seismic interpretation and as a subsurface collaboration tool.

Does this mean that ArcGIS provides some healthy competition to the subsurface software packages?

Morten Tønnesen, managing director of Oslo company Geocap, a company which supplies a plug-in to ArcGIS for interpretation and managing subsurface, seafloor and subsea data, believes that it can.

A big advantage of ArcGIS over packages such as Petrel is price and accessibility, he said, speaking at the Digital Energy Journal Stavanger conference on May 6, "doing more with subsurface data".

If your company wants to have 1,000 people accessing subsurface data, you probably won't be able to afford 1,000 Petrel licenses, but you can probably afford 1,000 user licenses to ArcGIS, he said.

And if your company already have desktop or enterprise licenses for ArcGIS, you won't need an additional license to use it for 3D work, he said.

GIS information is easily accessible over the web in ArcGIS, including with tablet computers, he said, and in a variety of IT configurations.

You gain access to the massive ecosystem around ArcGIS. It has over a million users around the world and 2,000 companies writing add-ons, including Geocap.

If you still want to do your subsurface modelling using the classic subsurface packages (made by companies such as Schlumberger, Landmark, LMKR, Roxar, and IHS) you might find it easier to use ArcGIS for sharing the data, he said.

Mr Tønnesen has a strong background in both geology and information technology. He spent 11 years working in Norwegian oil company Norsk Hydro from 1988 to 2000, including as both geologist team leader and subsurface IT manager, and from 2000 to 2011 he was with subsurface software company Roxar, ending as VP operations for Asia Pacific, Australasia and China. He joined Geocap as managing director in 2012.

Mr Tønnesen's company Geocap provides a layer which runs over ArcGIS software to manage and display subsurface data, he said. Geocap AS is a fully owned company by Geodata AS, the exclusive partner of ESRI for Norway.

Geocap's software can be used for seismic interpretation, geological modelling, seabed processing and calculation of maritime zones in accordance with UNCLOS.

What you can do

Imagine an oil company preparing for a license round, competing with many other companies for access to many different blocks, with enormous amounts of information already available.
"How are they going to cope with taking all of his information, absorbing it, understanding it and prioritising," he said.

By bringing all the available subsurface data into ArcGIS "I can basically have all the seismic data sets I can possibly have from my company at my fingertips," he said.

The GIS can take data from various data sources such as government data, the corporate well data and any seismic data from geoscience software without duplication of large seismic SEGY datasets.

Having all subsurface data together in the same database has been a long held dream of the oil and gas industry.

Discussions were already going on about a 'shared earth model', a common database for all subsurface data, in Norsk Hydro E&P back in 1994, he said.

Oil and gas companies want to present a wide range of subsurface information coherently, link it together, show it on maps, and use it with mobile devices, he said.

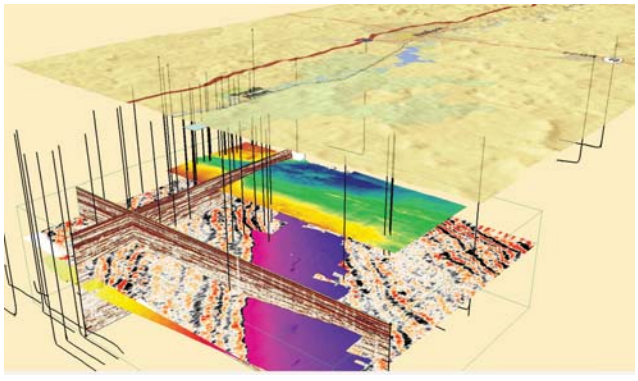
All of the seismic data is integrated, so you can draw a line from Norway to the UK going through many different oil fields and see all the 2D and 3D seismic, wells, interpretations and GIS data together.

GIS systems can easily provide background information. "I can click on any object and get the full information about the operator, and get the documentation."

You can also add well construction data into the system, exported from drilling or design software.

For offshore wells, you might need to have knowledge about the stability and contours of the seabed in the area where you are planning to drill. Some areas of seabed have trenches 50m deep, which make it impossible to install any subsea equipment.

For onshore wells, typically associated with



Geocap, running on ArcGIS, can be used to do subsurface interpretation and collaboration (also see front cover photo).

shale gas fields, there are many other factors you need to consider when deciding where to place your wells, such as how far away the nearest houses are, restrictions on where you can shoot seismic, and whether your well might go through an aquifer which supplies water to a city. ArcGIS with the Geocap extensions can help you integrate and manage surface and subsurface data to address production and environmental challenges. .

Oil and gas companies already use plenty of subsurface data on their existing 2D GIS, including the coverage map for seismic surveys, the locations of wells, the overall basin structures. So moving to subsurface data in 3D on GIS is not such a big step.

Collaboration tool

One person can send an instant message to another one saying 'have a look at this', the second person can bring it up in a standard www browser on their tablets, phones and laptops.

About 30 oil and gas companies are using Geocap for managing subsurface data, he said. "The first time it was tried, "people were chatting, commenting, and it really changed the way they decided to develop that field," he said. “So it’s a new world coming at us."

"It is a new way of communicating, a new way of sharing data, it complements at the moment very much the existing G+G expert systems,” he said.

Having many sources of data brought together can also make it easier to identify possible data problems. "It reveals a lot of quality issues just by doing this and sharing it. You send the message back to the geologist and say we have to look at that velocity model."

Comparison with retail

Retail and restaurant chains commonly use ArcGIS to plan their next store, when they want to take large amounts of data into account to make a decision, he said.

This is actually a similar process to oil companies planning where to site their next well. "You gather all the information and you plan for the best profitable business in accordance with regulations."

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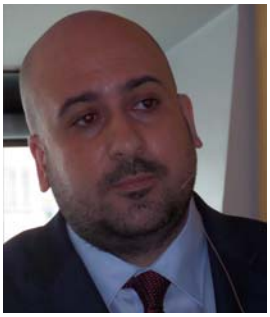
LKMR - Appealing to the younger geoscientist

Developing software which supports the needs of younger geoscientists by harnessing gaming technology into interpretation is a focus for petroleum technology company LMKR



The younger generation expects something different from their subsurface software applications, says Ali Ramady, European sales manager with LMKR

LMKR, the global licensor and developer of GeoGraphix geological and geophysical interpretation software, is placing an emphasis on making its products friendly to the needs of the younger geoscientists, said Ali Ramady, geophysicist and European sales manager, LMKR.

He was speaking at the Digital Energy Journal Stavanger forum on May 6, “Doing more with Subsurface Data”.

The younger generation, raised on video games, has different expectations to what subsurface interpretation software should look like, and software companies should bear this in mind, he said.

People expect high performance (speed) from their applications, and they expect them to be visually impactful. Meanwhile younger generations of people do not expect to understand how computers work. “The new generations know a lot less about computers than people did in the 80s. Generally, we don’t upgrade our gadgets we throw them out and buy new ones,” he said.

Younger geoscientists expect software tools which are more interactive and support communication and collaboration, with many people working on the same project. They expect to be able to work on their data from home. They also expect software tools which are very fast to learn, so they can start interpreting data in minutes, and have lots of automated tools for processes such as picking horizons and faults.

GeoGraphix

LMKR’s GeoGraphix interpretation software has been in production for 30 years – it was actually the third software application ever developed for Microsoft Windows.

“GeoGraphix is the most cost effective interpretation software in the market”, Mr Ramady claimed.

It often proves popular with small and mid-sized E&P companies and independent geoscience consultants.

LMKR’s GeoGraphix software originally started as a mapping application. It still runs on the geographic information system ArcGIS.

The software can be used to make 3D earth models, perform stratigraphic analysis and log correlations. You can do velocity modelling and depth conversion also.

A new module was launched in 2014 for creating field plans, allowing the user to lay out a drilling plan and to optimize the spacing of the wells to ensure the best coverage with the least number of wells. You can create ‘what-if’ scenarios, with different pad locations and different bottom hole locations. “The emphasis is on speed and flexibility,” he said.

“You can see subsurface models and wells together on a 3D visualisation”, he said.

In future, the software will be developed to support advanced interpretation and geomodelling (including engineering / rock physics data), having better tools to support field operations, do more for well data, have enhanced GIS (geographical information system) capabilities, streamline the workflows, and have more tools for reporting and data mining. “There will also be more tools to connect the software with other geoscience data and software in use“, he said.

Intelligent Energy - Plenary Session

The first plenary session of the Intelligent Energy conference in Utrecht, Netherlands in April looked at "aspirations" with speakers from Saudi Aramco, Statoil, Shell and ExxonMobil talking about where they would like intelligent energy to go

Ike Bellaci, senior petroleum engineering consultant, Saudi Aramco, said that the company's reservoir engineering aspiration is "to know the movement of fluids with time," he said.

"4D seismic promises such an outcome. But until it works, we are left with estimated models."

Saudi Aramco has managed to reduce its drilling costs with horizontal wells, but also found you are not able to take so many measurements at different layers of the reservoir.

An audience delegate asked if future wells could be more of a grid, with laterals running horizontally and vertically, rather than just one tube. "There could be tremendous value for this technology," he replied.

Saudi Aramco is gradually moving to more 'product based' teams working structure, he said, which is "hands on and collaborative, application based".

Statoil

Halvor Kjørholt, Leader Drilling and Well Solution Statoil, said that more than half of all offshore development spending goes on drilling, and drilling more wells is the most efficient way to increase recovery.

Statoil has achieved overall recovery of its fields of over 50 per cent, and it is "aiming for 60," he said. "This percentage will continue to climb. What it takes is cheaper, more efficient drilling."

"In terms of drilling performance, we can double the efficiency, take 50 per cent out of the time it takes to drill a well," he said. "Onshore, they have tremendously increased efficiency. We should be able to copy some of that [offshore]."

"Technology has had a big impact on drilling safety, but not drilling efficiency," he said. "I think there is a need for a revolution on offshore drilling and technology aspirations."

Mr Kjørholt suggested five ways drilling efficiency could be improved.

More real time well diagnostics could help improve drilling efficiency, so you would have accurate information about downhole condition including self-calibration capability.

"Panel at the opening plenary session of Intelligent Energy 2014"

Also technology for "Drilling sequence automation", where you can run the different sequences of drilling processes automatically rather than manually. "A version of this system is being installed in the Statfjord field of the North Sea," he said.

The industry has learned a lot from aviation and automotive industries in how to get autonomous systems running, he said.

"Drilling is operated like we operate an excavator. In future it will be much more process controlled," he said. "We tell the system which process we want. A lot will be operated autonomously."

Better downhole pressure control or managed pressure drilling would help. "It can be integrated in a drilling control system," he said.

Also robotic pipe handling on the drill floor.

It would be useful to drill inside casing, so you can make the well as you drill. "I see this as a way of making robustness in the downhole process," he said.

And real time reservoir navigation, so you can see around the drill bit during drilling.

To make this all work, "we have to develop the technology and we have to develop the competence," he said. "We are not there yet, but with five to ten years (we might). It is definitely something we can reach, at least on the technology side."

"We have to focus on preparing the organisation for this development. We have to have the right focus and some sense of urgency."

Klaus Mueller, Shell

Klaus Mueller, technology manager joint ventures with Shell, said he thought the industry could do much more with collaborative work environments (CWE). "I believe we use it for ten to fifteen per cent of what we could use it for," he said.

The lack of uptake of these systems "really comes down to people", he said. "You need someone who's really inspired [to get it working]."

But staff are getting much more enthusiastic about CWEs, he said. "Before, no-one wanted to be in a CWE, everyone wanted a cubicle. Now, no-one wants to be out of it."

Mr Mueller said he expects to see more mobile computing tools to be used offshore, which can bring people working offshore into the collaborative work environment. Future mobile devices might include RFID readers, gas detection and man down detection.

One challenge with the smart field is that a lot of the kit involved can be very demanding for maintenance. It does not mean a pathway to unmanned operations, but it might be a pathway to taking 10 operators out of the field and putting 2 or 3 back in who are more skilled, he said.

Mr Mueller said he has seen real improvements in enhanced oil recovery, although it does demand "the IE concept in a big way".

You need to respond quickly to any problems "because it's so expensive," he said.

When it comes to getting change imple-

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mented, "we tend to use engineers as change managers and that's not a good idea," Mr Mueller said. "There are professionals out there who can do the job better."

The contracting and procurement systems "can be a huge blocker" [to intelligent energy], "with the variety of different contracts you have," he said.

ExxonMobil

Mike Ryan, VP ExxonMobil Canada East, said that the company is moving towards a vision of 'completely unoccupied larger facilities'.

"We want to be less complex and have lower costs of development," he said.

Getting there will include more remote/ unmanned operation equipment, advanced automation, advanced surface and subsurface sensing, integrated surveillance and analytics, and advanced collaboration capability, he said.

It will also need less equipment and less redundancy

Calling for less redundancy might be surprising, but the point is that having more equipment can make the overall system less reliable. It is better to have less spare equipment but equipment you know you can depend on. An example is how transatlantic planes have gone from 4 engines to 2 engines, he said.

Training

A question was asked about how companies should get the right balance between training staff while working offshore, and training staff using collaborative work environments.

ExxonMobil's Mr Ryan said he thought onshore training might be more critical in future. "We have still too many people offshore. As we move work onshore we'll find ways to work efficiently," he said.

Statoil's Mr Kjørholt said "I see simulation as critical to compensate for lack of experience in the field."

Shell's Mr Mueller said, "Why should they get experience in something that's out of date? Like fixing a 1960s motorcar. There's other jobs developing."

First IE event

The audience were asked in a survey how many Intelligent Energy conferences they had attended before.

Over half of the audience said that this was the first Intelligent Energy event which over half of the audience had attended. 17 per cent were at their second conference, 12 per cent were at their third, 2 per cent were at their fourth. There have been 5 Intelligent Energy events between 2006 and 2014 and a further event in Dubai last year.

Plenary 2 - Intelligent Energy in the Assets

The second plenary session, "Intelligent Energy in the Assets", looked at what companies have achieved so far, with speakers from Schlumberger, Salym Petroleum and BP Angola

Andrew Mabian, Deputy Operations Manager, head of production operations with Salym Petroleum Development in Russia, said that his company has achieved "concrete and practical examples of the benefit of smart fields."

The aim is to "let teams have the right information, workflows, tools and capability to continually optimise Salym fields," he said.

The company's operations are 3 hours flying distance East of Russia.

It has 44 pads leading to 800 wells, a mix of injection wells (20%) and production wells (80%).

All the wells are lifted using electrical submersible pumps (ESPs). Data transmitted includes pressure and temperature data, and data about the ESPs – frequency, volts, amps, power, power factor, load, and vibration.

For water injection wells, the choke can be operated by remote control, and there is transmission of real time flow, pressure and temperature information, he said.

There are remotely controlled tools to add scale inhibitor.

As a result of installing the smart fields systems, it is possible for each operator to look after 70 wells. "We've been able to improve well integrity," he said. "We have visualisation of well status, so can make a quick response to adjust wells.

"Gas utilisation is 98 per cent and we have fewer trips to the field," he said. "All operation and maintenance staff feel that we are much smarter and safer."

Martyn Morris, BP

Martyn Morris, BP's regional president for Angola, who has been in BP upstream for 35 years, said he thought BP has a genuine 'Field of the Future' in Angola.

There is a FPSO anchored in 2000m of water, and 77,000 tons of hardware on the seabed.

"We have real time data from downhole, seabed, risers, topsides, all sent to our office in Luanda," he said.

The information is also sent to BP's Advanced Collaborative Environments (ACEs) in Sunbury and Houston.

There are downhole flow control tools to optimise water flood; subsea sand detectors which are so sensitive they can detect a ROV flying alongside a flow hole; subsea sampling capability; and multiphase flow meters.

BP uses 4D seismic surveys every "couple of years" to see how the reservoir is changing and monitor water and gas movements. "It has helped increase recovery by 15 to 18 per cent factor," he said.

"We did a lot of work on developing work flows and risk assessment," he said.

There is a slug controller tool which monitors the weight of the column of oil in the riser, and can automatically manipulate the inlet valve to make sure the slug doesn't get too large it can overwhelm the platform. "I don't believe we could have commissioned the SATERNO field without the slug controller," he said.

When it comes to challenges, "the hardest thing is getting the operators to use it," he said.

"On all the new fields, we build in technology and capability, but a lot of our old fields don't

have it. The challenge is to push to get people implementing technology."
One challenge is riser integrity. "The risers bringing the fluids up from the seabed are held in place by tensioned systems," he said. "The integrity of the riser depends on the riser remaining rigid.

"We have systems to maintain integrity of the risers, but I can categorically say it doesn't work."

Ashok Belani, Schlumberger

Ashok Belani, executive vice president of technology with Schlumberger,
said he thought the 'coolest' thing was Schlumberger's high performance computing network, which it is implementing all over the world, available via cloud.

Mr Belani said that it is very important to get applications integrated together. "Today, it's very easy to say, any application which is running by itself and not integrated it is a useless application."
He would like to see more regular analysis of data collected from wells. "Today we have a lot of permanent gauges deployed in hundreds of wells. A lot of data, every second over years. So gigabytes of data. The data sits and it doesn't do anything. Once in a while someone does all this analysis.

BP's Field of the Future project

BP's Field of the Future project is building real-time information systems which can keep staff advised on the status of wells, operations and production.

Developing real time information systems for BP: Steve Roberts, head of BP's Field of the Future Project

BP's Field of the Future project is developing online real-time advisory systems covering wells, operations and production to help provide employees with advice about current operations.

The tools give people insights into what is happening or about to happen, and provide information to help them solve problems and optimise operations. The systems are web based, functioning as information dashboards and advisor systems. BP hosts the services from its own data centres.

The Field of the Future team is one of 10 programs in BP's "Upstream Technology" organisation. There are around 30 core people in the team, based in Sunbury, Houston and Aberdeen, plus approximately 50 people from IT and many different contractors. It works closely with business champions in different functional disciplines in the company.

The "Well Advisor" tool covers safe and reliable drilling of wells, and is significantly reducing the number of stuck pipe incidents. This was developed together with Kongsberg. The team are also looking at monitoring well integrity for the lifetime of the well.

Steve Roberts, head of BP's Field of the Future project said: "The wells department of BP is now deploying the Well Advisor system to regions around the company."

The "Operations Advisor" tool provides information about the reliability and availability of equipment. It aims to give predictive advice on when maintenance tasks are likely to be required in the future, in a similar way to how a cars computer system can advise you when the brake pads are likely to need changing.

The "Production Advisor" tool gives advice to help optimise production. It connects data from the various subsurface systems. You can optimise short term and long term, and optimise across several assets at once.

Future proofing

The systems are being designed to cope with expected growth in data streams and development in technology but also to take advantage of ever increasing computing capability.

The data streams from wells, operations and production are increasing all the time, and so advisory systems like these need to be able to keep up.

Mr Roberts added: "Computer capacity is continuing to grow, yet it always seems to be possible to find a use to whatever high performance computer capacity is available.

"The Field of the Future team is trying to work out what is the best way to build systems so they can make the most out of future technology upgrades. I think we will succeed in implementing what we see today, but we will be locked into these and then fight another battle upgrading.

"There are various 'coping strategies' which might be adopted to help deal with rapid changes in technology. You can standardise technologies across the company, leading to fewer unique systems so that the upgrade task is simpler.

"You can also run more technology centrally, so it is easier to upgrade everything at once, however this can make you more vulnerable if there is a problem in the centre."

An approach Mr Roberts describes as 'agnostic' is to be as independent as possible to digital technology hardware and software in order to avoid being 'locked in' and having a large 'switching barrier'.

Caution is needed where you have 'intelligent' systems running, as remote systems can be harder to upgrade. During space missions, for example, scientists decide how much 'intelligence' should be on the spacecraft and how much at home. They can decide how much work to automate and take out of human control. They can also decide how much to simplify the business, particularly in the areas where different disciplinary groups have to work together.

Getting more out of data

Meanwhile, BP would like to find ways to get more out of the data it already has. "We're all struggling with where and how long do we store it for, but also how we get more from it," Mr Roberts said.

BP is aiming to cultivate people with skills to 'engineer data' - it is starting to look at the discipline of 'data science'; people trained in a classical way to work with data.

A data scientist is different to a data manager, as Mr Roberts clarified: "A data scientist can pull insights from data by knowing how to combine different types of information, engineer data flows and combination, understand the broad spectrum of analytic techniques, and is skilled in gaining insight that is useful to the business."

Plenary 3: Making IE a grand scale success

Steps which might help make intelligent energy a 'grand scale success' include taking a longer term view, understanding the pace of change, and perhaps getting more women involved, according to discussions in the third plenary session of Intelligent Energy 2014

To make Intelligent Energy a 'grand scale success', it might help to avoid using the word 'intelligent' because it can come across as patronising, said Paul Williams, managing director of operational performance consultancy WCG.

Perhaps the word 'intelligent' (in 'Intelligent Energy' is wrong, he suggested. "People say, 'I don't want intelligence, I want practical solutions to solve my problem.' Intelligence is a bit patronising," he said.

Not all projects have been successful, Mr Williams noted. When he was previously working at BP, delivering collaborative work environments linking onshore and offshore, "most withered on the vine".

A big problem was the differing cultures between onshore and offshore, he said. "Offshore people like their independence, onshore people like to reflect."

Mr Williams was so interested in oil and gas cultural issues that he left BP to become a consultant, specialising in "behaviour, team dynamics, relationships, emotions and process changes," he said.

People talk a lot about having an enthusiastic 'sponsor' for a change, but if the sponsor is too enthusiastic that can also cause the project to fail, he said.

"Change sponsors become marginalised, they keep taking about their ideas," he said. They often "concentrate on the technology, not the benefits."

And when projects get authorised to go-ahead, if you move too fast, you risk marginalising the people who don't like the idea, which can cause problems later.

The idea that humans resist change is not true, he said. Evidence for this is how excited people get when there is a new baby in the family. What people dislike is being told what to do, or having their objections ignored.

A further issue is that people underestimate the competition for senior manager's time. "I deal with senior operational leaders day to day," Mr Williams said. "You're competing against other [demands on attention] - HR,

Perhaps the name 'Intelligent Energy' sounds patronising to senior oil and gas people - Paul Williams, managing director of operational performance consultancy WCG. (standing). Behind him from left to right: Cindy Reece. Director of management and information with SPE, formerly Upstream Technical Support Manager with ExxonMobil; Trond Unneland Senior Upstream Advisor at Chevron; Leo Pirela, Global Director for Intelligent Fields and Asset Management Optimization, Baker Hughes; and Pieter Kapteijn, consultant, formerly director of corporate technology and innovation at Maersk Oil & Gas

system optimisation work. Your offering has to be better."

Pieter Kapteijn

Pieter Kapteijn, an independent oil and gas consultant and formerly director of corporate technology and innovation with Maersk Oil and Gas, also conference committee chairman of the first Intelligent Energy conference in 2006, had some interesting perspectives on the pathway of intelligent energy.

"When we started [with intelligent energy projects] we didn't know where we are going," he said. "When we arrived we don't know where we are."

We know that intelligent energy projects can work. "The fundamentals are there," he said. "There is so much collateral to show there is value to this."

Mr Kapteijn asked the audience if they thought intelligent energy had 'crossed the chasm', as described in Geoffrey Moore's famous 1991 book, where the 'chasm' is a big gap which a new technology is thought to have to cross in order to reach the mainstream.

In a show of hands, around 25 per cent of the audience said yes, but around 55 per cent said no.

Intelligent energy "is not a capability like any other capability, it is much more than that," he said.

The oil and gas industry had been talking about integration challenges for long before intelligent energy conferences started, he said. "33 years ago, the chief petroleum engineer of Shell said that the main problem with the company was integration."

One problem with technology implementations is that oil and gas companies do not see much urgency to implement new technology, they compete to get access to reserves, but after that the margins are usually healthy, he said.

Also oil and gas executives often do not take a long term enough view to recognise the benefits of new technology, with the average CEO being in place for 3.5 years.

Another point is that the oil and gas industry has an unnecessary "fear of complexity," he said.

"The industry is complex, but it is not difficult."

Top managers often drive for simplicity, saying "please capture it in three slides," he said. "Many people are driven towards over simplifying."

Mr Kapteijn recalled an experience early in his career when he was asked to make a presentation for the board of Shell (where he was working at the time), and they asked him to just show the most important three slides of his presentation, rather than the whole thing. He thought that senior managers should have been able to absorb all of it.

Another problem is the oil and gas industry's tendency to chop up problems in order to solve them, because it can prevent taking a broad picture view.

An example of this is the fact that Germany has built more wind power than any other country, but also its greenhouse gas emissions have gone up at the same time. "My view is that the big picture has been neglected," he said.

The pathway to Intelligent Energy might have been better if the intelligent energy advocates had put together a partnership with an asset earlier and got a real test project running, or brought in ideas from other industries, he said.

Mr Kapteijn noted that issues of "misalignment between the interest of individuals and the group" seem to come up more often in Intelligent Energy conferences than in other areas of the oil and gas industry.

Men

Rick Morneau, a former Chevron head of Strategic Research and Technology Development for Transformational Information Technology, asked if part of the reason so many projects fail is men. "Are we gender challenged?" he asked. "Men approach teamwork like a bobsleigh team, they want to be in front and everyone else is behind them."

Cindy Reece, event chairperson and former Upstream Technical Support manager with Exxon Mobil Corporation Upstream Information Technology, said, "in my own opinion, there are gender differences in how we approach things, but more strong personality traits."

Mr Kapteijn said, "The alpha male model is a competitive model, you can't do this [intelligent energy] in a competitive environment. Women tend to be better at guiding the overall health of the system."

Leo Pirela, Director i-field with Baker Hughes, said that competitive behaviour could be caused more by reward mechanisms than gender. "I've come across very competitive females," he said. "I don't agree the gender is the main cause. We [should] have systems to reward individuals, not teams. "Flat organisations can only work if you reward people for what they achieve as a team."

Paul Williams said that common personality traits of 'intelligent energy' people could be causing obstacles. "The personality of people in IE is different to personalities in operations. So you tend to marginalise yourself."

Biggest impact

Delegates were asked which of the intelligent energy technologies they thought has the biggest impact.

Leo Pirela of Baker Hughes said he thought that increases in recovery factor could have the biggest impact. "An increase in recovery by 1 per cent can be billions of dollars," he said.

Mr Kapteijn pointed out that when calculations make a discount on future earnings to work out their value today, you often find that the moves with the biggest short term benefit often win.

However at national oil companies like Saudi Aramco, there is more of a long term view. "The focus is always on ultimate recovery, it leads to different solutions. They have embraced this [intelligent energy]," he said.

Mr Williams said thought that the technology with the biggest impact is collaborative working environments. "I've worked in 50 [collaborative working environments] across the world. Humans working as one team has a tremendous effect on efficiency. They say hello," he said.

But it is always important to note than in surveys of why people joined the oil and gas industry, the biggest reasons always turn out to be "money, travel and prestige", Mr Williams said.

Tessella's "analytics partnership"

If you might like some data analytics done, Tessella offers long term 'partnership' arrangements – so you can have an analytics expert available on standby

Providing you with an analytics specialist under a partnership agreement - Nick Clarke, Tessella

International data analytics company Tessella is offering oil and gas companies 'partnership agreements', where they can have advanced analytics specialists always available to assist with solutions or just offer advice, under an on-going retainer agreement.

The aim is to make it easier to access a consultant on any specific project, by lowering the barrier to making that choice.

"If we have a partnership agreement in place, each client has the continuity of a dedicated contact within Tessella who really understands their business needs," says Nick Clarke, Head of Analytics at Tessella.

"We don't need to start a new conversation or draw up a new contract every time for every problem. We work together to identify and provide the exact capability needed in each case.

At the moment, it can be difficult and time-consuming for oil companies to assess whether they need to engage a consultant or can deliver an analytics project themselves.

The partnership approach stops client and supplier having to do that dance around the detailed specification of a problem and associated deliverable before anyone gets going, which can be a big frustration," he says.

"The potential value from analytics can easily be lost if it cannot be delivered with enough speed, and the last thing you need is to be stuck in contracts while your competition marches forward."

Tessella now employs 250 consultants with a wide range of domain expertise, including condition monitoring, image and acoustic analysis, advanced statistics and reservoir modelling. The partnership agreements give clients an easy and flexible route to accessing that full breadth of capability, when they need it.

Empirical vs engineering models

"Analytics is at its most effective when you can use a mixture of observed data together with engineering models to figure out what is happening now, and predict the most likely future," Nick Clarke says.

"It's the combination of the two that gives you real predictive and interpretative power," he continues. "To come up with a reliable interpretation of what's really going on, you need an underlying model you can track measurements against. It's how you get from correlations in the data that might mean something, to hypothesising causal relationships you can rigorously test for."

Achieving this with sufficient accuracy in remote or hostile environments can be a real challenge. As an example, UK nuclear waste processing plant Sellafield had a critical piece of machinery which required a metal bar to bounce freely inside a highly radioactive rotating drum.

Tessella consultants created an idealised model of the acoustic signature (sounds) that would be expected from a bar in good condition. They then fed the actual sounds (which were recorded in a very noisy environment) into an analytics engine that compared the evolution of the recorded sound with that expected by the model. Taking into account all of the combined uncertainties inherent in the idealised model, the background noise and the microphone (this was the clever bit), the analytics engine calculates the probability that the measured sounds indicate the bar is beginning to deform.

A wide variety of skills was required to develop a viable solution, and providing fast and easy access to them is what the analytics partnership is all about.

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Tendeka launches FloQuest 7.0

Tendeka has launched version 7.0 of FloQuest, its software for monitoring well performance and calculating production and injection rates based on data obtained from fibre optic cable and electrical sensors.

A primary aim of the software, according to Garth Naldrett, Tendeka's vice president for software and monitoring, is to make it easier to obtain valuable data through improved visualisation.

Mr Naldrett said: "The easier it is to access and understand the data, the more likely operators are to use it.

"For example, it can show you a visualisation of how the temperature at different points in the well is changing over time, next to a diagram showing how the well has been completed. This helps you to understand how the wells structure is affecting the temperature of the well," he says.

To provide fast visualisations, FloQuest 7.0 uses 'multithreading', a multi-operational process executed by a computer system, as well as new video graphics processing technology.

The software uses industry-standard communication protocols, enabling data and images to be exported to Microsoft Office software such as Word, Excel and PowerPoint. This allows the output of various file formats such as WITSML or CSV.

FloQuest 7.0 is part of the Quest software suite which has the capability to improve the efficiency and safety of both on and offshore operations by providing a clear picture of the behaviour of a well. This enables sound, mission-critical decisions to be taken by the operator.

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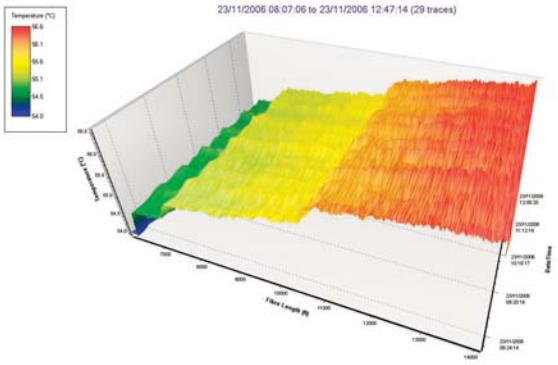

You can get better data visualisations from well fibre optics using Tendeka's new 'FloQuest' software

Intelligent Energy technical talks

Technical talks at Intelligent Energy included a scheme for measuring DOFF maturity, a method for managing safety overrides (both from BP), improving control system security (from ExxonMobil), structuring drilling data communications, and reducing people on board for drilling

DOFF maturity

Dave Feineman, senior advisor on technical business processes at BP's Field of the Future project, talked about efforts BP has made to define and assess the maturity of its implementations of Digital Oilfield of the Future (DOFF).

The idea of talking about 'maturity' for a technology implementation is not something new, but it requires some kind of agreement about what counts as mature, he said. "There's no agreed, model about how DOFF should be implemented."

"The road ahead is not very easy to discern. We can't [even] agree on what a digital oilfield is," he said. "And some projects have proven unsustainable."

There are many ways which DOFF maturity can be assessed, including various standard schemes for capability maturity, but to do a maturity assessment of a digital oilfield project is "difficult and time consuming," he said.

BP has made a lot of effort to track value generation from a DOF project, he said. Actually it has tried this 5 times. It sent out questionnaires to people in 2003 and 2005. The questionnaire got too long in 2005, so it did a shorter form in 2006. In 2013 it switched to doing gap and opportunity analysis.

"It was all a learning experience," he said.

Managing safety overrides

Brett Grange, a D2D (device to device) program engineer at BP, talked about his work developing a systematic way to manage the use of safety overrides in the company.

Delegates at the Intelligent Energy conference

A "safety override" is when there is a system for switching off a safety control. For example, a vehicle could be designed so that an alarm sounds if someone sits in a seat without a seatbelt on, based on sensors in the seat and in the seat belt clasp. The driver could be given a 'safety override' to silence the alarm if the seat is actually holding a bag of potatoes, not a person.

A technical talk at Intelligent Energy

In oil and gas operations, safety overrides are required to stop safety alarms sounding during special processes, for example when doing maintenance.

The problem occurs when safety overrides are kept permanently switched on because life is easier without a warning in your car when someone doesn't have a seatbelt on, or people forget.

So it is important to have a system to carefully manage when they are used, how their use is approved, and how to make sure the override is disabled afterwards, he said.

"We wanted something that could be implemented globally," Mr Grange said. "It has to be done in a way which manages and mitigates risk."

The first step was to build an electronic logbook, where people can report which safety overrides have been implemented. This means that the information is available to everyone. The system has been used in 27 locations, including the North Sea, Azerbaijan, Angola, Trinidad and Oman. "It makes overrides more visible to the operations personnel," he said.

The first version of the logbook was intended to help people be aware of what overrides were in place.

The second update manages how long the overrides are in place.

In the third update, the company started to categorise overrides, and introduced a concept of long term overrides.

The fourth update included easy access to risk assessment information.

In the fifth update there is a form to request approval to implement a safety override, and version control for risk assessment documents.

In the sixth update, there are systems to make it easier to audit, and there is a pre-request stage (so you can request permission to implement an override, before you actually have to do it).

In the seventh update there were tools to bulk upload risk assessments.

In future the tool will be developed to include local language options, local management of approvals, and clearer lines of communication.

Darrell Pitzer - control systems security

Darrell Pitzer, control systems architecture advisor with ExxonMobil, talked about some of the challenges with cyber security for control systems.

Control system equipment can often be used for decades. "Systems have a life greater than 10 years, often greater than 20 years," he said. "It is hard to upgrade these things."

It is also very difficult to build test systems for control system equipment, and many different groups of skill sets are required to understand it, he said. Also older equipment was designed with less priority given to cyber security.

Meanwhile hackers are continually building their knowledge. Hackers have built tools and search engines to help find control system devices over the internet, and have found over half a million control system devices so far.

Hackers are already discovering ways to exploit wireless communication and also virtualisation, where you use one server to do work previously done with several.

"The only solution is to manage the risk," he said.

"You can't eliminate the risk. The question is, what do you have to spend to reduce the risk to a level you are comfortable with."

Many companies have barred removable media (for example memory sticks) from their companies, as a result of STUXNET (a virus which caused damage to Iranian nuclear installations, transferred into the system via a memory stick).

Another process is known as 'defence in depth', where you have to get through several security layers. For example you might have a two factor authentication to log on to your corporate networks.

If you have obsolete systems which can't be upgraded, "you have to do what you can to make them inaccessible to the rest of the network," he said.

There is a growing league of professional 'penetration testers', people who you employ to test your system to see how easily it can be hacked. The testing has to be 'completely passive' to ensure that the test itself does not cause any problems, he said.

He was asked if it is possible to find penetration testers who understand industrial control systems. "We found one they are very happy with. The penetration market is just discovering the industrial control space," he said.

Eigen - helping drillers with ISA99

Murray Callander, chief technical officer with integrated operations technology company Eigen, talked about some of the work Eigen has done to help operators of drilling rigs get compliant with the ISA99 standard for industrial automation and control systems security.

Eigen started one project in 2009 to get a drilling rig compliant with ISA99, redesigning the way data was stored and transmitted on the rig.

"The vision was one cable. Each company just plugs in one cable and they get access to everything they need (and nothing they don't need)," he said.

The company had a very complex and vulnerable data communications network, with rig operations outsourced to a third party, multiple companies working on the rig and a data communication network built organically over the years, with no knowledge of what was connected to what.

This meant that there was no means of controlling the entry or exit points for data, or users, including remote access, he said.

"The more complex the system, the more the scope for fragility. Robustness and resilience are essential. The system we deployed had to be more resilient than any of the systems it interconnected."

Eigen designed a high-availability structured data and communications system to replace it, which could tolerate failure of about 50 per cent of components, he said.

The real time drilling data from the rig can now be sent to the oil company and other companies over the internet using WITS or WITSML data standard, as well as OPC. There is a central server which can receive data from the drilling control systems via WITS, WITSML or OPC.

The Drilling Control and Monitoring System (DCMS) is completely protected. It is not possible to access the drilling control systems via the internet, or even from other networks on the rig.

To make sure it would work, Eigen built a mobile testing kit so it could visit the various software vendors and test out their software with it. "We had to get into every single interface and understand the workflows," he said. "We had to map and take apart every single interface."

The Realtime Drilling Information System (RDIS) was implemented for the client in November 2013, and 3 wells had been drilled using it by April 2014. "The system was installed in the construction yard and was available as soon as the rig was on station. There's zero non productive time associated with it," he said.

As a result of all the testing carried out, the system has been modularised and can be deployed as a package on other rigs. "It has proved that it is possible to engineer systems that are both secure and easy to use," Mr Murray said. "It moves us towards our goal of being able to deliver a capability, not just a technology."

To improve the system further, Eigen is looking at increasing resilience even further using solid state hard drives, among other things, which are less prone to failure, and improving systems for remote management, he said.

Reducing people offshore for drilling

Schlumberger has a trial scheme to see if it might be possible to reduce the number of people who are involved in a drilling project, by having two of the traditional four man crew working remotely, said Schlumberger's Leonardo Toco.

Remote drilling [having remote staff supporting drilling work] has been widely done around the world on land based jobs, but not much on offshore, due to higher operational risks.

Reducing manpower for offshore work could have much bigger benefits, due to increased safety benefits of having less people offshore, and freeing up rig space.

If you have 50 drilling rigs in a certain part of the world, taking two people from each rig means a 100 person reduction in people on board, he said, or 100 beds freed up for someone else.

The experiment was made for specific drilling tasks, including MWD tool programming, acquisition system configuration, pre-job quality checks and daily drilling reporting.

In order to have remote crew working on a drilling project, a reliable satcom link is essential. You need to ensure that the data communications is sent over the network by high priority and have a dependable backup link, he said.

In a trial, the company found that most of the time the communication is made using online chat and voice communication.

The company also found that the drilling rate (counted in feet per pump hour) went up and the non-productive time went down, he said.

When digital engineering is normal

When digital engineering becomes normal business, at some point in the future, companies will only upgrade further with technology which is fully tried and tested. Dutch Holland and Jim Crompton try to imagine it By Dutch Holland and Jim Crompton

Boring business meetings: what will it look like when Intelligent Energy is 'business as usual'?

Not every application of digital engineering will be ambitious and glamorous.

Our purpose in this article is to paint a picture of digital engineering applied in a very conservative company in which management sees digital technology as only a tool, and is reactive when new technology is available has been available for a while.

In such a situation, digital engineers could serve in a simple technology-watch function to help ensure that evolving digital technology can be identified and harnessed for business value.

This conservative situation focuses more on the adoption of emerging digital technologies rather than organisational or process changes around the full capabilities of digital technology. This situation consists mainly of independent projects driven from bottom-up initiatives.

New technology replaces legacy tools, but the business processes, organizational structures and cultures remain pretty much the same. There are many cases of incremental improvement and some new capabilities, but their Digital Oil Field of the Future is not all that different from the current one.

The digital engineering in this situation can play an important role in these technology projects and becomes a valuable contributor to asset performance. But other than their prowess in using the new digital tools, their role is not significantly different than their predecessor.

The Digital Oil Field initiative slowly disappears from the scene as some other new initiative takes the headlines.

Technology watch or a technology assessment process is not new and has likely been staffed by a team specially focused on this task.

But digital engineers assigned to technology watch will behave differently from their technology predecessors and will bring a 'business value' perspective, sophistication and maturity to the review of new technology. The digital engineer will look beyond the glitz of the technology innovation to the potential impact of the technology on both engineering and business process applications.

(Fictitious) case study

Thanks to the steadfast commitment of its employees, Amend Energy is a top 15 independent U.S. E&P company with approximately 5.0 Tcf of proved reserves in producing U.S. basins.

Headquartered in Houston Texas, the company's core focus areas are the Mid-Continent, Permian Basin, Hugoton Basin and the Rockies. Amend has approximately 1,000 employees spread across more than a dozen locations in the United States.

Amend Energy's primary business objective is to provide stability and growth of distributions for the long-term benefit of its investors. The company's business strategy is to grow through acquisitions of long-life, high-quality US assets; organically grow reserves and production; reduce cash flow volatility through hedging; take advantage of digital technology if and when it becomes available.

In this case, we have a very technology-conservative and operations-centric management. The organisation and culture still emphasizes functional excellence but do not yet look at opportunities from a cross-functional or integrated supply chain perspective.

At management's current level of maturity, they certainly will not sit still for a full-fledged digital engineering approach to doing business … but some digital engineering might still be possible.

Digital engineers at AEC

Imagine: Charlie has just returned to the technology department in AEC, his oil and gas company, after spending two years away working on a Master's degree at Texas A&M (on the company's nickel). Charlie is excited about being back on the job and is eager to start applying some of the new things he learned in school.

Charlie says, "Boy I can hardly wait to get up to speed on the new cool technologies the oil field services companies and technology vendors have been working on! I was able to see some of these new developments and how they are being applied in a couple of my courses, and I really think our company could do more on the technology side. There is a major SPE technology conference coming up in two months, can't we all go and scout some good stuff to bring back to show the business unit operations groups?"

Not looking for technology that way

Josh (a teammate of Charlie's) says:

Well, Charlie, I can tell you are excited, but we are not looking for technology that way anymore. While you were away at school, our department got together as a team around some of the new work on digital engineering, and we re-thought the processes we had been using and decided that we needed to make some major changes to better serve operations and the company."

This is the way we were working before you left:

As technical organization members become aware of new technologies, they bring them to the attention of operations in informal meetings, conversations, and invitations to attend vendor briefings.

In some cases, the technologists advocate certain technologies without having directly connecting them to specific work process improvements.

We tried to get funding from the business units for further development of these technologies but had mixed success and only limited adoption.

We would maintain informal awareness of the operations side of the business, where they are and where they are going from a technology point of view. Rotation assignments, between the business units and the technology department, were the best way to keep up with what each other was doing.

We would participate in professional society meetings (SPE,SEG, AAPG), read technical literature, attend vendor showcases, and invite vendors to give us demos on emerging technology products and services to hear about what is new.

We would scan new technologies where ever we can see them, and assess technology capabilities to solve some of our operations challenges.

We would acquire specific tools and try them out as proof of concept trials or pilots with interested business unit asset teams, and pass along observations to operations through our information personal networks as opportunities arise, and assess the degree of interest.

Or we would put on a full-court press to sell new technology to operations with promises of business value, because of our interest in and excitement about the technology.

Now the way we are working is as follows:

Assigned "Technology Watch pros" seek information on technology applications that are immediately relevant to the critical metrics and priorities in operations work processes.

"Technology Watch pros" not only are passive collectors of information but are proactive in seeking information from other energy companies about technology applications that have led to processes that increased business value.

Technology Professionals work with specific disciplines (drilling, reservoir, production, facilities) in the business units to identify and prioritize technical challenges that operations is facing in current production and in new projects.

In addition to the search for new hardware and equipment technologies (for drilling it might be: dual gradient drilling, new composite material for risers and tubulars, or new drill bit designs), we identify sources of information about digital technologies companies are using to improve processes (such as real time drilling centres, passive seismic for monitoring frac jobs, or fibre optic down hole measurements).

We prepare and conduct forums with functional representatives from different business units to discuss operations development directions, applications of new technology (both physical and digital) used by operators to solve similar development directions. They find out what vendors are telling them, and what business value other companies have obtained from use of applications of new technology.

With operations engineers, we identify opportunities for trying out new technologies in the field

We work with Operations to determine next steps and gain commitment for action (both funding, resources and field pilots)

We prepare vendors to deliver targeted presentations to interested groups in business units, and negotiate a commercial partnership to conduct a field pilot

We continue to work with operations to select proven applications that have led to process improvements and business value for others, and that might be able to do the same for us.

Charlie says. "Wow! That is a big change. Is this what you learned from looking at Digital Engineering? What have you accomplished so far?"

Work with operations

Amber (a teammate of Josh and Charlie) says, A lot of what we did was just common sense, but we did get some key ideas from our digital engineering readings and discussions.

For example, we learned it might be better if we worked with operations as a team before we looked for technology to better understand what we should be looking for, rather than finding some neat application we think is cool, and then throwing the app idea over the wall to operations.

Teaming up with operations has really paid off for everybody. Talking to operations and then screening down to a couple of processes and technology has worked well. We have identified several pilots with drilling and production groups.

We are working with one service company to set up a real-time drilling center for our new deep-water drilling program and already have three rigs hooked up to the centre. We have already saved several million dollars on one well with the reduction in non-productive time.

And, finally, we got a really good picture of what our jobs are likely to look like in the near future when we and our friends in operations work together in new ways as Digital Engineers.

Jim Crompton

Dutch Holland

Jim Crompton is managing director of oil and gas data management consultancy Information Pipeline and a former senior advisor on upstream IT with Chevron. Dutch Holland is president of Holland Management Consulting. They have written a book together "The future belongs to the digital engineer", available on www.amazon.com

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The oil and gas data production line

The oil and gas industry can be seen as a data production line, with data flowing between different departments and gradually getting refined. With each step, some of the value is lost. Ketan Puri of Infosys explains

Ketan Puri, Enterprise Architect - Big Data and Analytics, Infosys

To get maximum value from oil and gas data, we need to ensure we tap the data in the most granular form and transfer it to the enterprise (decision making) applications in fastest possible manner.

As data is processed, it loses its value due to loss in granularity and the time it takes to reach the enterprise applications.

The data undergoes disintegration, and transformations to cater to needs of different applications and in turn makes it difficult for analytical tools to extract real value.

Dependency on different data sources with proprietary data formats is created to extract the real value out of the data. This leads to loss in time and limits the enterprise to make timely decisions.

Vertical steps

Many steps are involved in the vertical journey of data from source to upstream enterprise applications.

First, the raw data gets captured by the on premise upstream systems.

It gets enriched and transformed into industry standard formats.

The data is extracted, transformed, published, and loaded into the enterprise data centres. The data centres aggregate this data and make it available to the business applications for consumption.

Data gets filtered, transformed, or new data is synthesized in different formats based application needs and network limitations.

A grain of data is the lowest level detail created by the source system identifying the first occurrence of an event characterized by a set of parameters. The granularity of data is a measure of how close it is to the grain.

Business classification

We can classify data by "business" - whether it is for exploration, development or production.

Data work in exploration involves analysis of subsurface data and making 3D visualizations to understand the geology. The data streams can be analyzed in flight to correct the data errors. It can be staged directly to the enterprise High Performance Computing data centers for near real time analysis.

Data work in development projects includes making data models to identify optimal drilling geometries and well spacing, based on exploration data and past drilling data from other wells.

Data work in production involves monitoring safe operations of wells, including data for temperature, pressure and fluid injection.

Data Analytics, including real time and historical data analysis, can help develop data models for safer operation. Analytics models can be created to analyze the production of one well in relation to other wells in the same region or similar wells across geographies.

Frequency based classification

Frequency based classification means if it is high frequency, medium frequency or low frequency.

High frequency data is generally produced by the sensors, well site data, construction operations related to wellbores, drilling, service data, SCADA systems and other devices associated to subset of drilling, exploration, and production operations. OPC and WITSML data falls in this category.

Medium frequency data is associated to production related activities, time series data, operations, lab analysis, well completion, flow networks. The time unit associated ranges from Hours, Days and weeks.

Low frequency data is associated to geospatial data, structural, stratigraphic (faults and horizons), fractures, time and depth.

Granularity based classification

Granularity based classification means classifying data according to whether it is raw data, operational data or standardised / refined data.

Raw data is the data produced by the different devices at site locations. This is the most granular form of data. Tapping into this data in real time can generate enormous value to the business.

Operational data is the data captured by the standard upstream systems with proprietary processing logic catering to the operational needs of the business. This includes SCADA systems, vendor specific assets to generate drill logs, Alarms and Events, Historical data logs, and sensor data. These systems consume the raw data and provide mechanism for the system operators to monitor the health of the upstream operations.

Standardized data is the transformed data into various industry standard formats. It caters to different segments of the upstream business.

Integration based classification

An integration based classification for data decides if it is streaming data, staged data (eg files and documents) or data about specific events.

Streaming Data is produced using custom streaming programs or off the shelf product stacks from various vendors. It converts the raw data produced by the low level systems into data streams bypassing the complicated layers of the enterprise.

It provides the ability for Real time data analytics and faster access for the enterprise to react to the system anomalies. Derived analytical data is produced as a result of analytical techniques and models.

Staged data can be in form of files or database. The streaming data can be stored into Massively Parallel Processing data stores for in depth analysis by use of advanced statistical methods and predictive analytical techniques.

Events and Notifications can be generated using data models on top of both the streaming data and staged data. These can facilitate timely response strategies catering to different business scenarios.

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