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United House, North Road,
London, N7 9DP, UK
www.d-e-j.com
Tel +44 (0)208 150 5292

Editor and Publisher
Karl Jeffery
jeffery@d-e-j.com
Tel +44 208 150 5292

Advertising sales:
David Jeffries, Only Media Ltd
djeffries@onlymedia.co.uk
Tel +44 208 150 5293

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Cover photo: Cyberhawk, which claims to be the global leader in drone and software solutions for energy assets, increased turnover by more than 50 per cent in 2020 and increased headcount by almost 100 per cent. See www.thecyberhawk.com

Emerson

Moving industrial plant computing to the cloud

Much of the systems and data for managing industrial plant are about to be moved from 'on premise' to the cloud, reckons Emerson's Peter Zornio. It will be a 'platform change' as big as the move from workstations to 'Wintel' in the mid 1990s

Cloud for plant operations is "potentially a big platform change that will impact us in the world of operations technology and automation," said Peter Zornio, Chief Technology Officer with Emerson Automation.

Mr Zornio envisages that automation systems will go through a platform change similar to the way mainstream computing went from mainframes to workstations, and from workstations to PCs.

"The problem with a mainframe was when you ran out of horsepower you had to get another mainframe. Everybody dreamed, 'if I could just have my own computer, so I don't have to share with other people.'"

"Of course, that happened," he says, when we moved from mainframes to UNIX workstations in the engineering world. Everybody could have their own computer, although its processing was done on a central machine.

Then in the mid-90s, there was a move to Windows operating systems on Intel computing infrastructure, what people now call 'Wintel'.

"That started a computing environment that has been with us ever since," Mr Zornio said. "It is still the standard computing environment for the automation world and the IT world."

'Wintel' computers have been used for the past 2 decades, both for personal computers and for servers, handling e-mail and enterprise software.

The first commercial cloud services, launched around 2010, were "rent a data centre", enabling people to avoid the capital expense of having to operate their own. You would run the same software applications in someone else's data centre, Mr Zornio said.

Peter Zornio, Chief Technology Officer with Emerson Automation

"It was like a big virtual mainframe in the sky, but infinitely scalable."

"The IT departments of the world, once they saw the advantage of moving in this direction, have been accelerating in this direction, using cloud ever since."

OT and IT

Much of the drive to move plant systems to the cloud is coming from IT staff, who are increasingly getting involved in the operations technology (OT) world, and are already comfortable running everything on the cloud, he said.

When automation systems did the transition to Windows in the 1990s, it meant the OT and IT worlds were using the same platform – and opened up many years of discussions about whose 'domain' it was.

"IT guys looked at a lot of automation equipment and thought, it looks like the same stuff we use, we should be owning that," Mr Zornio said.

But since then, most companies have been keeping the OT world separate to the IT world, having it on separate networks or using firewalls. "Systems were connected but weren't really integrated."

Emerson tried to provide people in the OT world with pre-configured equipment, so they did not have the complexities of running IT systems.

"There was a long time of "peaceful co-existence". OK IT guys, here's your data, now leave us alone, we want to run our environment."

In the domain of life science, there has been more integration between IT and OT, he said. Perhaps life sciences has been the most aggressive in moving IT technology to the manufacturing world.

But today, "digital transformation" programs are pushing IT people to get more involved in the OT world in all industry sectors.

"Nearly everyone we serve has some kind of digital transformation program going on. Many times it's run by the IT department, sometimes OT and engineering groups."

Many digital transformation programs have forced a much tighter integration between IT and OT, such as projects delivering data to mobile devices, augmented reality, and bringing in third party connected services.

And as IT people have influence on the OT world, they are bringing in their preferences – including for cloud technology.

"We see IT departments directly tackling

operations problems by pulling in data, running machine learning, trying to solve some of the problems that OT departments have been trying to solve for quite a while."

Although you normally need a domain expert, someone who understands the process, to solve a problem. "A data scientist sometimes comes up with some, quite frankly, silly conclusions or things which are obvious to people in the plant. But the combination of the two does enable solving new problems."

Some business now have single teams looking after both IT and OT. Probably all companies will go in this direction eventually, as "one integrated computing team."

OT and IT typically work on different time scales, where OT people are used to keeping equipment running until it fails, where IT people are used to implementing new software all the time.

By merging IT and OT, you can get much more IT capabilities in the OT world – such as wireless communications in the field, data analytics in the cloud, and more data storage capability.

If you want cloud hosted services, "by definition you have to have IT guys involved - they're going to want to know about data privacy rules, where data is stored."

On premise vs cloud

This leads to the question of which software systems should still be kept on premise, if you are moving much of it to the cloud.

The operations technology world has traditionally run everything on premise. It makes sense when you are talking about software which actually runs equipment.

But non-time-critical applications, such as data historians, could be moved to the cloud.

Organisations with data which is not very time sensitive, such as a farm, might be comfortable running all of their systems on the cloud. If anything fails with the digital technology, the corn will still grow.

The automation world is different. The vast majority of Emerson customers "want to have the ability for plants to continue to operate without the cloud. If they lose the internet connection they can still reliably run their plant."

So perhaps what we will see is production plants having a core system on site which runs the plant, including sensors, control systems and visualisations, and everything else going to the cloud, he said.

Other issues to consider are whether you like the low capital requirements of cloud software, how much technical depth you have in your organisation, and how well your organisation is able to adopt change.

Some companies have a specific policy to try to get rid of all their IT hardware and go 100 per cent cloud.

Data tools

There are increasingly sophisticated data tools available on the cloud, and this strengthens the argument for using cloud software. It is no longer just about renting computers, it can be about renting an operating system, including capability for data storage and data analytics, Mr Zornio said.

Cloud providers are acting more like software companies (or software companies are becoming cloud providers).

For example Microsoft offers tools to "virtualise" data via a cloud service (show data from multiple sources as though it came from the same data store).

There's still a lot of work you have to do yourself to turn that into a real application. IT people are often willing to do this work, while OT people usually want to only use software which has been built specifically for their equipment, he said.

Cloud hosting companies see an enormous potential market from people who want to 'ingest' streaming data. It used to be only manufacturing and industrial sites who were interested in streaming data, but now we have buildings, farms, car parks, and cities steaming sensor data, who want a way to store and analyse it.

Companies like Microsoft and IBM "want to build things that go across all the markets, not just manufacturing and industrial," Mr Zornio said.

Security

Some people raise concerns over security of cloud data, "but many people will argue that cloud vendors have more time, money and people to put into security than any one company does."

"This is all they do - store data. They have hundreds of the best people working on security. It's not perfect, but they probably have more resources to apply than any one company would do."

One way is to set things up so data from the OT world can only go one way, like a "data diode". Data can come out, but bad things can't get in.

Emerson

Emerson has partnered with Microsoft's Azure as its preferred cloud provider – and about 15 different Emerson solutions are available on Azure as "software as a service".

Emerson has software called "Plantweb Optics Data Lake", which can connect to data streams from sensors, stream the data to the cloud, and "historize" (store) it.

This saves operations technology people from the trouble of working out the best way to connect sensors to cloud systems. This can be very tough in some circumstances, such as where you have an older system, and you don't want to risk overloading its processing capability with an additional demand.

Emerson has also set up a cloud centre of excellence, where it makes cloud software, and ensures the services are secure and consistent.

"This is a big platform transition for us," Mr Zornio said.

Emerson – people are still confused about analytics

One of the obstacles with getting analytics technologies used in upstream oil and gas is that there is a lot of confusion about what the technologies do, says Peter Zornio of Emerson

"There's been so much discussion around digital transformation. You hear [terms like] AI, ML, all different kinds of technologies around analytics," says Peter Zornio, chief technology officer for the Automation Solutions business of US engineering products and services company Emerson.

"What we found is, a lot of customers are still confused about analytics."

"Everybody hears about analytics, but OK, [they ask] where do I start, what do I use, what's different to what I'm doing today, I thought I was [already] using a number of analytics technologies."

"There's no doubt there's a lot of hype, with claims like 'analytics has the ability to create order out of chaos in any amount of data'".

"Typically you are doing analytics as part of a digital transformation program."

That's because you're trying to improve your operational performance - safety, reliability, production, energy and emissions, while driving a more empowered workforce, a more knowledgeable workforce."

"We have good goals when taking analytics and applying analytics."

One of the sources of confusion is that most discussions about using analytics in industry in general are about consumer decision making, or perhaps hiring processes, he said.

Emerson is focussed on analytics that are

aimed at the operational space, something which should be of high value to operators.

It is important to manage the complexity of these projects, so they don't get overwhelmingly difficult.

"The digital transformation programs, they are tackling more and more complex IT technology. We absolutely strive to take away that complexity, and deliver solutions for specific problems, so customers don't have to wade in and assemble their own solutions."

Principles or data driven

Emerson sees analytics methods in two groups, principles driven, and data driven.

"Principles driven" is where the model has knowledge of the physical principles on which something operates. This is equivalent to knowing that a car needs fuel to go. The principles can be used to develop rules. "If your car isn't starting and the gauge is on empty (E), you don't need more data," he said.

"You're doing "failure mode effect analysis" in your head." This is a method for evaluating a process to identify where and how it might fail.

"We can use the same principle for more complex pieces of equipment. We know what the things are which can result in different failures. Then we can trace back to what they are."

"When we have a first principles model, that's the best place to start."

Recently, there's been more interest in "data driven" models, where patterns are seen in the data but not relating to any physical characteristics, such as spotting what products are good to advertise to somebody who has just bought something, he says.

The data can be simple, fitting a curve to points so you work out how something tends to relate to something else, or more complex technologies like pattern recognition.

A good approach is to start with principles driven analytics, and then move to data driven analytics later only if you need to.

"There's a lot of opportunity just in those low level equipment applications to use first principle analytics and failure mode / effects technology to tell you what is going on."

In one study in a petrochemical facility, "we looked at the categories of equipment, we determined that we could detect over 80 per cent of known failure modes with a first principle model, if you had the right sensor data on that equipment."

"As you move up the chain of complexity, you move to data driven models, or combining a first principle and data driven model."

"We have a tremendous amount of IP in that area, over 500 templates of models of equipment, for how they will fail."

These are known as FMEA [Failure Mode and Effects Analysis] models.

Ready made solutions

Emerson finds its customers often only want software which is already built to do what they want – they don't want a toolkit to build things themselves.

"They don't want to have to take their process engineers, who are busy keeping the process running, and turn them into data scientists. If they can get a package which is already done, they are very happy with that."

"We supply a number of solutions for preconfigured models."

Engineers can normally be comfortable using principles based analytics tools. Although to use advanced pattern recognition / AI tools, you will normally need more data science expertise, he said.

Data quality

The bulk of the work in data analytics projects is normally getting the data in a usable manner. Getting insights from good data could be considered the fun part. If managing data quality is the 'cake' of the project, doing analytics can be the 'frosting', Mr Zornio says.

"If you don't have the data, useable in a contextualised manner, there's no cake, you can't put the frosting on," he says.

"Everybody is figuring out that they need to get data in a usable manner."

"In the past, people said things like, 'just send me all the data, whatever system you have, vibration monitoring, lab system, just send all the data to me - in the cloud, I'll run ML on it and find out wonderful things.' That's turned out to be fraught with issues."

"And these operational systems they want the data from, they have a job to do, running the plant. When you bombard them with continuous requests for 'all the data' they get overloaded."

"Many times there's very specific and potentially old legacy software interfaces. The operational system can be 15-20 years old. There's unique interfaces to get the data out, typically a layer of networks to move the data through."

Data sources can include distributed control systems, data historians, maintenance systems, and laboratory equipment. "You get a spaghetti of connections, its very complex."

"Many customers have historians, you can try to grab all this data and directly send it to the cloud. But when you can do that - how usable is it?"

"A huge problem is making that data consistent and contextualised across the different data sources."

Many companies have multiple labels for the same thing. "In one system it might be 'pump 101', in other system it is '100101'. When it gets to the cloud, are they the same thing? People spend the majority of their time organising and cleaning the data that they're sending in to this analysis environment."

Slow progress

Many companies are progressing slower with digital transformation than they expected, for example reaching a point today, which "they would have hoped they would have been 3 years ago."

The work involved in adopting technologies like augmented reality often proves much bigger than people anticipated. "It is a nice technology, but the actual integration of it into the workflow, getting customers to fully adopt it, the workforce to fully adopt it, making sure it works all the time and has all the data behind it, has been a much bigger challenge for most of our customers than they realised."

A good approach is "start by defining a problem and what the benefits [of solving it] will be, don't start with the technology. Then figure out what technology to buy, and how to get it used by the workforce. That last part has proven to be one of the hardest things."

About Emerson

Emerson has been providing analytics tools for industrial plant for many years, such as diagnostics tools in devices which give you early warning of what is going on. It has also been doing analysis of rotating equipment for a "very long time," such as analysis of a vibration profile. "That would now be called machine learning," he said.

"We have a complete portfolio of sensors and equipment that can sense what is happening with rotating equipment."

To make it easier to gather and integrate data from multiple sources, Emerson has a technology called "Plantweb Optics Data Lake."

"We're able to connect up all those data sources from the OT world. We support the legacy interfaces. We put all that data into a consistent, contextualised data model."

One customer installation takes 3m data streams per second, and provides the data to over 1000 people.

IOGP – standardising operations to decarbonise

The International Association of Oil and Gas Producers (IOGP) has a number of projects to standardise oil and gas operations between the majors to help decarbonise

"About a year ago [The International Association of Oil and Gas Producers] were challenged by the heads of engineering of the top 12 operating companies in the world, asking what we can do to collaborate to progress our collective net zero ambitions," said Richard Mortimer, chairman of the International Association of Oil and Gas Producers (IOGP) standards committee.

Mr Mortimer's main job is VP engineering with BP global products organisation. He was speaking at the Emerson Users Exchange meeting online on March 29-31.

There are a number of organisations working on environment related projects, such as the Oil and Gas Climate Initiative (OGCI) and IPIECA, (originally the International Petroleum Industry Environmental Conservation Association). But they are not focussing so much on operations engineering aspects, he said.

One of IOGP's working groups is looking at a new standard for methane measurement.

"We're looking at more and more use of drones, aeroplanes, satellites to monitor GHG emissions, how we reconcile those top down measurement techniques. We're working together to understand what best practise is. We're looking to pool the knowledge and understanding to see if we can find any breakthroughs."

There are working groups on flaring. "We are very inconsistent with our design and use of flare gas recovery systems. They are often a bit of an add on in many companies. The reliability is not as it should be."

An IOGP Joint Industry Project called "JIP 33" is looking at how to harmonise and standardise how the operating companies procure equipment for projects.

It is common today for oil majors to give suppliers a list of their own requirements for common products such as pumps, which go on top of standard industry requirements, set by organisations such as the American Petroleum Institute (API). This creates a lot more cost for suppliers, which is passed onto operators, while not adding any more value.

"Operators got together and said 'this is insane, we're not adding any value by these company specific requirements,'" Mr Mortimer said.

JIP 33 has its own website, at https://www.iogp-jip33.org/ where you can learn about the work of the 20 working groups.

The project is supported, including with financial resources, by 12 operators – BP, Chevron, ConocoPhillips, ENI, Equinor, ExxonMobil, Petrobras, Petronas, Saudi Aramco, Shell, Total and Woodside.

Altogether, the oil and gas industry is "dramatically aligning on a net zero agenda," he said. "You can see it in a whole range of different ways."

Richard Mortimer, chairman of the International Association of Oil and Gas Producers (IOGP) standards committee (screenshot from webinar)

BP

At BP, "we absolutely need to adapt and adopt digital technologies quickly," he said, in part to meet the challenge of transforming from a traditional hydrocarbon industry into one where 'new energy' plays a much bigger role.

And since BP has set its goal to transform its company with fast adoption of digital technology, "it's more and more important to stay connected with the supply chain of those digital technologies," he said.

Improving uptime on a platform using automation

Richard Sharp, Facilities Support Squad Lead at BP, Aberdeen, explained how BP is using automation systems to improve uptime (or reduce the risk of downtime)

Richard Sharp, Facilities Support Squad Lead at BP, Aberdeen, explained how BP is using automation systems to improve uptime, speaking at the Emerson Users Exchange meeting online on March 29-31.

Mr Sharp is involved in instrument diagnostics on BP's Clair Ridge project. This is a drilling and production platform linked with a bridge to a living quarters and utilities platform, which started production in 2016.

BP had a project to eliminate unplanned "production deferral" – a term which means stoppages of oil and gas production for unexpected reasons such as faults.

RTD fault

One example of a problem which caused stoppages of oil and gas production had a root cause of a faulty Resistance Temperature Detector (RTD) on a gas compressor.

Typically the failure of one RTD "doesn't cause much of an issue," he says.

But as a result of not fixing the faulty sensor, when it was followed by a second failure, it caused a gas compressor to "trip" (automatically switch off), and that caused the whole gas compression train to switch off.

With no gas compression, there was no fuel gas being supplied to the power generation, and so a loss of all the power.

There are 150 people on the facility, and if they all have to rely on emergency power supply, the potential for a major accident is increased.

Of the two failed devices, one of them had failed a number of months earlier.

There was actually information about the failure in the "AMS Alert Monitor". This is plant asset management software provided by Emerson.

"We hadn't been looking at the alert monitor so we didn't know about it until the final RTD failed," he said.

The cost of this was 70,000 barrels of deferred production. "As you can see, simple things like this escalate quite quickly."

Better monitoring

There are many tools available to monitor the systems, but they are not necessarily being used. "What we as an operations team had to do was make sure we were maximising the capability from these [monitoring] tools," he said.

This might mean moving the data into another system where it could be better analysed or addressed.

In the past, field instrumentation was just pneumatic devices with moving parts inside. Today, "the instrumentation we've got installed - its so much more than providing you with an indication of pressure level, flow and temperature. You get a vast array of other information."

"I think the biggest part of that now is how do you make sense of it in such a way that it can provide business benefit."

The system the project team developed was to take data out of the AMS Alert Monitor and feed it into the work management system. This meant it had systems to ensure that alerts were picked up and addressed, and problems fixed.

The project team developed a system to export the alert monitor from the Integrated Control and Safety System (ICSS) into Microsoft Power BI (business intelligence) software.

"We could do whatever we wanted with that data," he said. "Power BI was an incredible analysis tool. We could start to see the wood from the trees."

BP developed a flowchart system which could be followed to make a decision about whether something needs to be acted upon immediately (reactive), or if it can be put through the work planning process, doing the work at the most convenient time in future.

BP wanted to make sure that the technicians had time to look at all the data daily, and do the corrective work.

The company started by picking 3 instruments – the 3051 Rosemount pressure transmitter, the 3144 Rosemount temperature transmitter, and the Fisher DVC 6000/ 6200 digital valve controllers. These amounted to 70 per cent of the total "tags" (devices to be monitored).

The project took about 18 months from the first aspiration (mid 2019), to finalising the visualisation (January 2021). BP worked together closely with Emerson.

In one case, it identified a defect with the potentiometer on a control valve. It was working but in a way which was "less than ideal". But having advance warning of a problem meant that the corrective work could be planned to be done at a convenient time, when the whole production facility was being shut down for other reasons. And of course it also meant that the defect was fixed.

It was able to do some device configuration remotely. "This was hugely valuable, avoiding having to mobilise an individual offshore. Beds are very much a premium on offshore facilities," he said.

Having better understanding of the condition of equipment can also help avoid being in a situation where excess gas needs to be flared, which has CO2 emission implications.

Altogether 35 defects had been identified and eliminated through planned work processes, by March 2021.

"Rather than create a new work process, we interfaced with the existing work process. It fitted right into what was in place already," he said.

Richard Sharp, Facilities Support Squad Lead at BP, Aberdeen (screenshot from Emerson meeting)

Digitalising a Middle East oilfield

Intech Process Automation told the story of its project with a Middle East oil company to digitally transform one of its oilfields, at a Emerson user conference

Huseyn Tarek, VP Middle East and Africa, Intech Process Automation, presented a case study of a digital oilfield project with an (unnamed) Middle East oil company, He was speaking at the Emerson Users Exchange meeting online on March 29-31.

In 2016, Emerson and Intech, as its "channel partner", were chosen to carry out a project digitalising wellheads and well / tree valves (Christmas trees), providing real time data communication, on sites around the territory.

The project had to meet specific requirements for reliability and proven availability, and a design life of 25 years.

The systems needed to have capability for remote operations, with assets monitored from a central location and minimal local intervention required. The central location would also need data to support analysis and decisions.

The wells needed capability to be shut down remotely in the event of an emergency.

Systems were to be implemented on 200 wells, both existing and new. Some had no power or water infrastructure. There was a lack of detailed engineering information.

The devices would need solar power, and transmit wirelessly.

A second objective was to achieve integrated production operations management. "A fully functional SCADA was required," he said.

For predictive analytics, as well as just data from the well, you would need surveillance tools, data management processes, visualisation tools, and automation of workflow for tasks.

System developed

The system developed has sensors on the well head, connected to a well head control panel, with all data then transmitted wirelessly.

The well site equipment includes Emerson's PSD (Process Shut Down) and (RTU) Remote Terminal Unit systems.

There was triple redundancy in the controllers.

All input-output devices have monitoring capability, so you can see if they are working or not.

The Remote Terminal Unit gathers data from the instruments, and prepares it for transmission to the central processing facility. It also controls the choke valves and works with devices to monitor the integrity of the well.

"This all did not come that easy actually," he said.

The Christmas trees and downhole valves are controlled by hydraulics.

Six processing facilities were connected to a central integrated operations centre, with a video wall, providing an overview of the field. You can drill down to see data from individual sensors.

"We learned that preparedness at the time of installation and commissioning was (key) to increase speed of the project and to overcome challenges," he said.

The project ran over five years. The design needed to be continuously improved while the fabrication was taking place.

The equipment was built on a skid, so it could be put together in a warehouse and transported to the well site fully built. This reduced the onsite installation and commissioning time by around 50 per cent.

Advances over the past 10 years mean it is possible to implement the whole system in one go, rather than in bits and pieces, he said.

The communication system, using WiMAX protocol, could be tested before delivery.

Emerson's CPE400 controller was used for the data connectivity.

"Tools are available which can enable the overall integration of the field from the sensor to the boardroom."

"10-15 years ago we could not have thought about controlling the downhole valves sitting in the headquarters."

It is possible that the customer may wish to use the data to develop automated tools to make decisions, "which could enhance their productivity."

Defining digital oilfield

A digital oilfield could be defined as "an end to end solution which covers processes, people, assets, technologies and above all a strong belief in the power of digital intelligence," he said.

"It is better described as a concept not a physical presence."

According to this concept, information can be integrated and analysed in many different places, not just a purpose built room. "Many people think of (digital oilfield) as a digital hub with hundreds of flashing screens and people earnestly taking notes."

Digital communications between the various sites and automation systems are also part of the digital oilfield, he said.

The goal is that productivity is increased, and experts can spend time on the most important analytical tasks. It is about decision making, not just operational processes.

It should lead to safety improvements, from having fewer people travelling to and working in dangerous environments, with data being gathered and communicated automatically.

There are also cost savings, from not having to have people at the well site, and recovery benefits from being able to better manage the reservoir.

About Intech

Intech Process Automation specialises in bespoke automation projects in the oil and gas industry, such as brownfield upgrades or complete automation / electrical / digital projects.

It has offices in Houston, Kazakhstan, Indonesia, Singapore, Shanghai, Lahore, Dubai, Saudi Arabia, Iraq, UK, Nigeria and Angola.

It has 450 staff, including 250 automation and electrical engineers, and 35 data scientists. It has completed over 2000 projects.

OSDU releases third version of its platform

The Open Subsurface Data Universe (OSDU) industry organisation has released the third version of its data platform, called "Mercury"

The Open Subsurface Data Universe (OSDU) industry organisation has released the third version of its data platform, called "Mercury".

The first two versions of the OSDU platform were limited to a "common code base with common data definitions, extensibility and multitenancy," OSDU says.

But with the Mercury release, the OSDU platform now has "features which are focused on delivering value and increasing ease of use for exploration and development workflows," it says, with "features an end user would find valuable and are aligned with our vision to transform the way we work."

The release has "Domain Data Management Systems", which enable the platform to be more "performant" in allowing software applications to access the data.

About OSDU

The aim of the Open Group Open Subsurface Data Universe Forum is to develop a standard "data platform" for oil and gas subsurface and wells data.

This might also be described as a standard way for storing and structuring data within a company. It does not mean that data is shared between companies.

This should make it easier for people in the company to access subsurface and wells data, build "workflows" for taking data from one stage to another. It will be easier to search data. It should make it easier for people to build new products and services using the data, so driving innovation.

A core principle of OSDU is that data should be separated from applications.

At the moment, much subsurface data is linked to applications, which means that the industry is "applications driven" rather than "data driven", and also keeps data locked in silos.

Discussions started in Spring 2018 with a number of oil and gas companies.

OSDU has an Open Source approach, which means that any company of any size can contribute new features to the platform, supporting new business workflows.

All work is validated by the OSDU Program Management Committee (PMC) to ensure it is aligned with the overall direction of the Forum.

OSDU is developing a "reference architecture" - a recommended way that IT products and services can be structured together. This will also be 'implemented' on clouds from Microsoft, Amazon and Google.

It will define standards for applications.

Operator members are Anadarko, BP, Cepsa, Chevron, Concho Resources, ConocoPhillips, Devon Energy, Equinor, ExxonMobil, Hess,

Marathon Oil, Pandion Energy, PETROBRAS, Reliance Industries, Shell, Total, and Woodside

Supplier members are Altus Well Experts, AWS, Baker Hughes GE, Beyond Limits, Bluware, CGG, Cognite, Dell Technologies, EACIIT, Emerson E&P Software, Energistics, Flare Solutions, Google, Halliburton, Hitachi Vantara, IHS Markit, Ikon Science, INT, Interica, KADME, Katalyst Data Management, Larsen and Toubro Infotech;

Logic Solutions Group, Microsoft, OAG Analytics, Oliasoft AS, Osokey, PGS Geophysical AS, Quantico Energy Solutions, Qumulo, Schlumberger, Searcher Seismic Geodata, SecurityCompass, Softserve, Target Energy Solutions, TGS, Triton Data Services, Troika International, Well Log Data, Wipro, and XMPRO.

Quotes

"At the heart of most energy companies' strategies is embracing the transformational technologies taking us forward in today's digital era," said Johan Krebbers, GM Emerging Digital Technologies / VP IT Innovation, Shell, in a press release quote.

"This makes the need for a common architectural design clear, one that underpins how our industry works with its data."

"Data is at the heart of BP's transformation into an integrated energy company," said David Eyton, EVP Innovation & Engineering, BP.

"We believe that the future of the energy industry will be data driven and dependent on its ability to manage data in a manner that promotes data sharing with partners, innovation through data science, and rapid decision making throughout the lifecycle of the energy value chains."

"Being a founding member of the OSDU Forum, BP has had an opportunity to be part of an organization that is fundamentally changing the data landscape for our industry."

"By integrating energy organizations, cloud services providers, and software vendors, the OSDU Forum is providing an opportunity for collaboration that will be beneficial for all involved."

"We are very excited about the Mercury Release of the OSDU Data Platform and look forward to expanding this approach into engineering, emissions, and new energy."

Schlumberger

In March 2021, Schlumberger and Microsoft announced a partnership to offer services over OSDU, which is called the "Schlumberger Enterprise Data Management Solution for the OSDU Data Platform," running on Microsoft Azure. They can also connect data in OSDU format with data in Schlumberger's "DELFI" system.

In April, Schlumberger announced a 'strategic project' with operator Equinor and Microsoft, to deploy Schlumberger's DELFI subsurface data 'environment' integrated with OSDU. The data will be hosted on Microsoft's Azure cloud.

"This project aims to accelerate Equinor's ability to integrate data at scale and improve decision making," Schlumberger said.

"This provides a single, unified landscape with seamless access to data that enables the industry to rapidly run AI and data-driven workflows, creating a game-changing increase in efficiency."

It will become part of Equinor's enterprise wide platform, also on Microsoft's Azure, called OMNIA.

Software included is Schlumberger's "DELFI Petrotechnical Suite", its "ExplorePlan" exploration planning solution (which Equinor was also involved in the development of), and "data science solutions from Schlumberger".

"We're excited to champion OSDU as the industry standard platform that integrates our data into the DELFI environment," said Lisa Rebora, senior vice president of Exploration Excellence, Equinor.

"Our collaboration with Schlumberger in the co-creation of ExplorePlan will enable our geoscientists to draw more insights and generate more ideas and opportunities through access to a wealth of data at their fingertips."

"In this next important phase during 2021, we will deploy ExplorePlan to our geoscientists, connecting seamlessly to our OSDU-enabled OMNIA data platform."

Ikon Science

Also in March, Ikon Science announced it was collaborating with Amazon Web Services, to put its geopredictive knowledge management system "Curate" on the AWS implementation of OSDU.

Wood Mackenzie, ThoughtWorks and Agile

Data provider Wood Mackenzie worked together with Agile software consultancy leaders ThoughtWorks to develop new digital products for managing and sharing data

Wood Mackenzie, perhaps the oil and gas industry's best known and longest running provider of data and research, has been teaming up with software consultancy ThoughtWorks to develop new digital products.

ThoughtWorks, headquartered in Chicago, which has a close connection to the developments of Agile. It has employed two of the original 16 signatories of the Manifesto for Agile Software Development in 2001 - Martin Fowler, who formerly had the job title of "chief scientist", and Jim Highsmith, who is now retired.

Wood Mackenzie wanted to bring its digital products and services together into the "Lens" platform, and also find ways to "improve responsiveness to customer demands and accelerate new product delivery, with a lean, agile, value-focused delivery culture," ThoughtWorks says.

Wood Mackenzie wanted to ensure it could handle much bigger data volumes being created, and have a standard foundation for its data, ensuring consistency and quality.

ThoughtWorks wanted a "flexible, platform based product delivery approach," which Wood Mackenzie's teams could use. Its staff would be able to make frequent changes to multiple products, without needing software development expertise, and with the data all on the same foundation.

The "Lens" platform would also make it easier to combine different data sets, so it was possible to ask new questions, and develop new products faster.

The initial product on the lens platform, "Unconventional Valuations", was a system for valuing unconventional oil and gas production assets in the US. This values assets in terms of net present value and the cash flow of oil and gas. Investors and companies can search for assets by geographical location or owner.

"Wood Mackenzie had previously run into difficulties developing this as a new platform-ready product, so success was critical," ThoughtWorks says.

"With competitors already offering digital alternatives in the Unconventional Valuations market, rapid development and deployment were key to gaining market share."

Fast delivery

"The ThoughtWorks team delivered the first working software to production in just four weeks, and had an initial MVP (minimum viable product) ready for internal usage, product testing and customer feedback in just three months—helping Wood Mackenzie get to market quickly, and make up for lost time," Thoughtworks says.

"The successful development of the Unconventional Valuations product was very valuable to the Wood Mackenzie team, supporting growth in customer subscriptions in an exceptionally challenging Covid-19 year."

"During the initial trial process for the new product, 12 external clients signed up as development partners—providing vital input that would shape the product and help guide development of future Lens platform products," ThoughtWorks continued.

"The project led Wood Mackenzie to embrace Continuous Integration / Continuous Delivery approaches, after identifying this as a hurdle issue early on during development."

"The interconnected nature of the platform meant multiple teams needed to coordinate closely for any release. An issue in one product could hold up the entire platform, slowing down releases by up to four weeks. The team quickly identified this as something that could threaten the speed and flexibility of the Lens platform."

"Now, Wood Mackenzie's Continuous Delivery approach ensures that all delivery teams can now deploy independently of each other, enabling faster product deployments multiple times a day at a lower cost across the Lens platform."

Current projects

ThoughtWorks and Wood Mackenzie have embarked on more projects connected with the Lens platform.

They are developing a common API gateway so the Lens platform can connect to other software applications. This common gateway will "simplify and improve monitoring, performance, and security."

They are improving data discovery across the complex data sets, "ensuring consistency of valuations and insights generated from the vast volumes of data".

There is an "ambitious" project to enable customers and Wood Mackenzie analysts to save, share, update, and collaborate on valuations and insights created within the Lens platform.

ThoughtWorks is working with Wood Mackenzie to improve its global asset valuation product, which calculates a value for any oil and gas asset in the world. The aim is to bring in energy transition and renewables data, and further develop a portfolio analysis tool, so it is possible to do calculations for geographical areas as well as single assets, or do calculations of the value of all assets owned by a company.

Evaluating deals

In November 2020, Wood Mackenzie announced a new solution "Lens Upstream Optimisation", for E&P companies, banks and investors to find the potential value of deals, and compare portfolios.

It promised that users would be able to "simulate the economic impact and tax implications of M&A activity on company portfolios within seconds, with results visually displayed in automatically generated maps, charts and tables."

"Our cloud-hosted valuation engine processing large volumes of upstream economic data at speed has enabled us to bring our customers a range of significant business workflow efficiencies, from key insights generated in seconds, to eliminating manual error-prone tasks through automated data ingestion via our Lens Direct API service," said John Dunn, head of Upstream Product Management.

It would enable companies to build portfolios of "advantaged assets" - which could be defined as low cost, long life, and low intensity in carbon.

"The time to result is up to twenty times faster for assessing opportunities, testing 'what if' scenarios or scanning the market for potential buyers and sellers. Within Wood Mackenzie's M&A research team, we are already realising massive efficiency gains for our own analysis," said Greig Aitken, Head of Wood Mackenzie's M&A service.

"From my prior roles in upstream business development and investment banking, I know first-hand just how laborious analysing potential upstream deals can be," said Chris Grieve EVP of Strategy & Corporate Development.

"Whether actively working on a portfolio or getting to understand competitor bidding strategies, the initial screening using Lens Upstream Optimisation can be done in just a few clicks.

"By having deal notes turned around in seconds, leveraging the latest weekly asset model updates from Wood Mackenzie, E&P and investment professionals alike can spend more time on detailed due diligence of highly prospective deals instead of hours and days screening deals only to find them unsuitable for a company's portfolio.

"It's changed our workflows for good and delivered new analytical benchmarks."

Intelie – analytics with major drilling company

Intelie, a drilling analytics company, developed an interesting way to work with an offshore drilling company client – providing partly built models which could then be finished off.

Analytics company Intelie, which specializes in drilling, has developed an innovative way to work together with drilling company customers – providing partly built models which can then be extended.

Intelie has a main office in Rio de Janeiro, and offices in Houston, London, São Paulo, and Dubai.

The offshore drilling company (whose name cannot be mentioned in this article) had been looking for ways to use data to optimise maintenance, and then to improve equipment uptime. The work started in 2016, with the first 2 years spent mainly finding better ways to acquire the data on shore.

By the end of 2019, the company realised that it could also use the data to better manage emissions, including to find better ways to understand how it generates power and emissions being produced. So, it developed a parallel project with Intelie to look at that.

The project covered data from all the equipment involved with drilling, including the blow out preventer on the seabed, and the drilling package, such as mud systems, draw works, control rooms, derricks, pipe handling systems, rotary tables, power tongs. There is data from engines and the dynamic positioning system, as well as cranes, power generation and electrical distribution.

Drilling operations have gathered drill bit data for many years (logging while drilling / measurement while drilling), although that data is generally handled directly by oilfield service companies, rather than being handled by the drilling operator.

The equipment already had sensors fitted on them, but the data processing and visualizing was designed for the purposes of the operators of the equipment, not for analytics. So, analogous to a car dashboard, which is designed to tell you what you need to know to drive a car, including to be alerted about problems, but not to (for example) monitor long term trends in engine performance.

To do this, the drilling company needed to get access to the data in the back of that system.

So, there was a process of aggregating data offshore, compressing it, and consolidating it on shore.

It ends up as an enormous amount of data, perhaps thousands of sensor points every second, from the fleet of vessels being monitored in this way.

Modelling

The problem was integrating the data together, or 'modelling' it, in a way which could provide the drilling company staff with the insights they wanted.

A common approach with analytics is to take lots of data and try to model it, so a data first modelling approach.

But the drilling company took the approach that, since it already knew what sort of things it wanted to find in the data, it only needed data models to be built to look for them automatically. For example, when staff already know what the common 'failure modes' of equipment are, they just want automatic ways of looking through the data for them.

Intelie was chosen because it was happy to let the drilling company maintain ownership over its domain knowledge where many data analytics companies wanted to own the algorithms they created.

Intelie also had building block tools, which could be defined as building blocks or partly built models, that the drilling company could use to make the full models themselves.

Intelie had some staff sitting in the drilling company's offices, so they could learn how the business worked, and also teach the drilling company about analytics. And it had other staff in its main office in Rio de Janeiro.

A drilling company's approach to data is very different to how a large scale manufacturing company might approach data. A drilling company has a diverse range of equipment, with a few years of data from each piece of equipment. A large scale manufacturing company might have data from hundreds of thousands of products. This means that the conventional machine learning approach, which is designed for enormous data sets, may not be applicable to drilling.

Maintenance and emissions

The first objective for the drilling company was to use the data to improve how it does maintenance.

A big target from the project is learning about the best time to do maintenance, getting a better prediction of the lifetime of equipment, and being able to adjust the maintenance interval of equipment used more or less than expected.

The data can give advice if there is an anomaly in some equipment, so you can stop and investigate at a time which does not impact operations.

The second objective was to better understand emissions.

Drilling operators did not consider emissions and fuel consumption much in the past, because they did not see that they could do drilling without using fuel, and so emitting.

But a surprising outcome of the analysis was that one of the biggest sources of emissions in offshore drilling is from fuel used to power the dynamic positioning system. A DP system is not something offshore drillers can manage without. But this is still a useful insight to have.

The amount of data needed for studies on how to optimise and reduce the carbon footprint is small compared to the amount of data being used to optimise maintenance.

Much of the equipment related to emissions is made by different manufacturers, and reconciling it was a big challenge.

Project challenges

The toughest problems with the project, from Intelie's perspective, were handling sometimes unstable data streams, prioritising the work, and developing tools which would make the work easier, says Ricardo Clemente, co-founder and co-CEO with Intelie.

The operational world "has complicated data coming in, he says. "Links go down, sensors are replaced, the mapping is not 100 per cent, you have different equipment, hundreds and thousands of data points to manage."

In any analytics project, 80 per cent of the work goes on data engineering preparing the data for the analytics, with 20 per cent of the work doing the models.

But once you have built a data platform to handle the data, and a platform to do analytics with it, new opportunities to get insights from the data may emerge. "You see a problem that was not on the radar at first," he says. "You have a long tail [of opportunities] that emerges."

Intelie has developed what it calls an "operational AI platform," called Intelie LIVE, a software system designed specifically for handling operational data and doing analytics on it.

The operational AI platform uses a mixture of machine learning models, rule based "if / else" logic models, theoretical physics models, observed / empirical models, and signal processing, looking for trends in the data.

The drilling industry has many specific examples of how equipment fails. These failure modes can be programmed into the system as rules, so they can be searched for in the data.

The platform has been designed to be flexible, with a number of "solution bricks" – pre-built components such as engineering models, visualization tools, and other 'widgets' which customers can use.

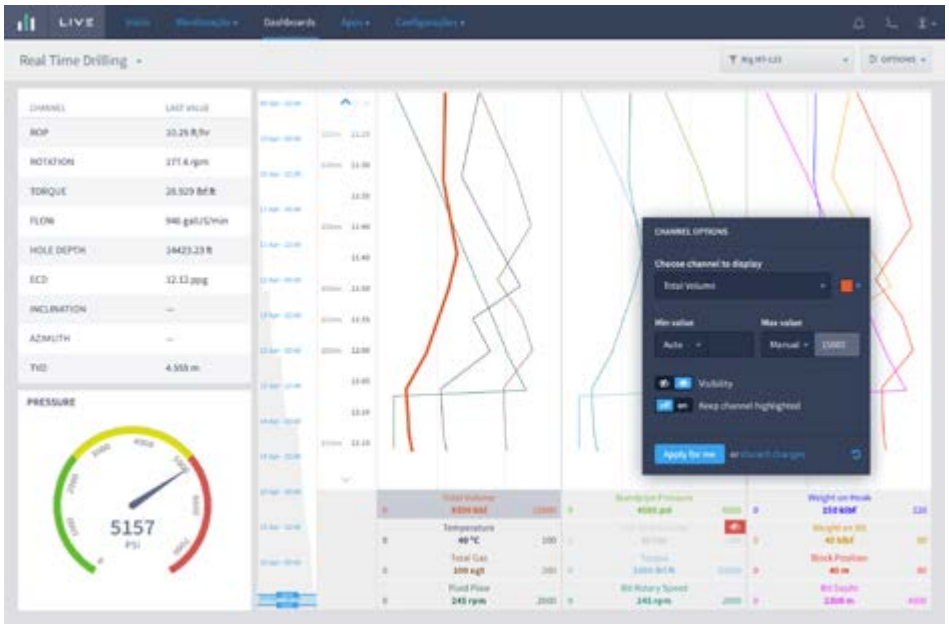
These widgets are "like Lego blocks," he said. You can literally break down the pieces and build something new on top. If you don't like the spaceship, you can put the pieces back together differently.

Intelie also has its own query language "Intelie Pipes," which customers can use to build their own models, working with data from time series sensors.

It has an event processor which can aggregate and normalize real time data from a range of sources.

It provides prebuilt functions, such as a rig state detection macro, and a WITSML connector, to gather drilling data provided in WITSML standard format.

Customers can edit these existing functions as if they are editing "Excel macros." As an analogy from the operational world to the finance world "They [customers] can say, 'I didn't like the way he calculates NPV, I want to change the discount rate from this to that.'"



Customers have a choice of using Intelie's tools, or developing their own tools, and then owning the IP themselves, he says.

Business model

Intelie's business model is to provide its platform on a subscription basis, and then charge additional fees for its pre-built apps, such as its hydraulics model and a rig performance solution.

Typically, customers will use a lot of the pre-built apps, particularly when they are smaller and don't have the budget or capability to build in house.

"Big operators have a lot of engineering, and R+D capacity. They may say, 'I think my performance model is better, and I don't want to use yours. I want you to code my model. I want to make this production-ready, to be able to handle hundreds of thousands of measurements a day. But you can't share that with anyone else.'" "Our business model recognized that, it gives customers that flexibility."

Intelie has been working with Petrobras since 2011, and the software is now used on all its drilling operations. It also works with several other majors, like BP, and drilling operators.

The company was acquired by Houston oil and gas satellite communications and networking company RigNet in January 2018.

Baker Hughes – 'outcome based' solutions with digital tech

The big challenge for oil and gas companies today is to work out the best way to use digital technology to get the right outcome for the business, not just having the right monitoring or diagnostic capability, says Baker Hughes Digital Solutions

What oil and gas companies really want today is help and advice on how to put the various digital technologies together so they can see how to achieve their high level goals, says Rami Qasem, Executive Vice President, Digital Solutions, Baker Hughes.

Clients are looking for "outcome based solutions" today, he says. Data from all of their various sensors and devices needs to be 'rolled up' so the "the end user gets one recommendation and one outcome." This means much more than having monitoring or diagnostic capability.

So Baker Hughes focusses on helping companies better manage "the whole value chain of the operation, providing the right advice, focusing on an outcome based solution."

Rami Qasem, Executive Vice President, Digital Solutions, Baker Hughes

The COVID pandemic has pushed many clients to think about better ways to manage their operations, and perhaps also given them more time to think about it, he says. "That's a key theme of everything that's been happening. You have seen how the industry has been transforming more rapidly on the digital front, than we have seen a decade ago."

"The way I think about it, you need to first prescribe and decide what you're trying to achieve, based on the outcome you are trying to achieve," he said.

The top level goals for every oil and gas com-

pany involve safety, emissions and productivity. But then the first step to achieving these goals is usually to achieve a certain level of reliability with the operations. There will be certain assets which are more critical than others in achieving a reliable safety level. Or reliability may depend on certain aspects of your supply chain.

"Then you will be able to decide - what is the missing part in all of this, in order to reach the right outcome," he says.

Baker Hughes worked in this way with Petrobras. It did not start by saying "here's a new system we're trying to sell you". It started off with asking, "tell us the problem you face," Mr Qasem says.

Petrobras said it had over 6,000 sensor systems across all of its assets, but had difficulty figuring out how the whole sites were connecting together. Having this connected view was important for being able to answer questions such as, do we have enough feedstock.

Petrobras also had specific goals it wanted to achieve, like "reduced greenhouse gas emissions".

Once these high level goals are defined, the next steps might be to install better ways to measure flaring or methane emissions, and connect this into a comprehensive digital ecosystem. "You will be able to find a better way to connect the dots," Mr Qasem says.

Depth and breadth

Providing such outcome based digital solutions involves both depth and breadth.

The depth element involves understanding how company's businesses work, and how new technologies work. For example, Baker Hughes has projects to use AI on drill bit data, enabling better insights into the condition of drill bits. It helps customers better understand how new technologies may be relevant to them, such as applying CT scanning devices from the healthcare industry, or using 3D printing.

The breadth aspect involves connecting different elements and understanding to get the right outcome. Companies are seeking to break out of their old 'silo' structures and move to having a horizontal digital enabled structure, with better joining of the dots. Achieving breadth can also mean deploying technologies at the right scale, across the client's entire operations, not just in one place.

Another example of breadth is where it helps a client tackle multiple goals at once. For example methane monitoring devices and systems can help with emissions, safety and production at the same time.

Inventory management

An important part of achieving reliable operations, and one which is often overlooked, is better management of inventory of spare parts and feedstock. Companies need to be sure they have whatever they might need quickly available, but they do not have unlimited capital and space available for goods in storage. But the demand is often unpredictable.

Baker Hughes has been working together with the company C3.AI as its strategic partner, developing AI based methods to plan inventory.

Mr Qasem's business unit has worked with C3.AI for its internal purposes, to reduce its inventory of stocks and to plan future manufacturing, including making predictions of future customer demand.

Baker Hughes Digital Solutions

Baker Hughes Digital Solutions is a multi-billion-dollar business unit.

It provides a range of digital devices under a number of brands, including condition monitoring (Bently Nevada), sensing such as for flow and temperature (Druck, Panametrics, Reuter-Stokes), control systems and cybersecurity (Nexus Controls). Also industrial inspection (Waygate Technologies, Process & Pipeline Services).

It also provides monitoring systems, software and services to connect all their data together in a digital ecosystem. It serves 20 industries, not just oil and gas.

The company has its own R&D centre in Oklahoma City, USA, which it calls its "Energy Innovation Center".

Using unstructured data to reduce down time

A lot of the insights which might help to reduce equipment downtime and improve maintenance planning are hidden in unstructured data in historical records. Subrat Nanda of ABS explains how this might be utilised

By Subrat Nanda, Chief Data Scientist, ABS

In the offshore industry, we are currently sat at the tip of an iceberg in regard to unlocking the potential held inside unstructured data.

If leveraged effectively, these data driven insights can inform decisions across an enormous scope of critical business functions – from improved operations and informed planning to focused training and personnel development.

The potential to advance safety performance is also significant.

Unplanned downtime, as we know, is costly for all offshore operators. A study by Baker Hughes found that 1% of unplanned downtime (i.e. 3.65 days a year) costs offshore oil and gas organizations on average $5.037 million annually.

The industry averages a little over 27 days of downtime every 12 months, which translates into costs of about $38 million. For the worst performers, figures are upwards of $88 million.

An effective asset management strategy can start with combining data analytics with historical data and operational experience to reduce unplanned downtime and achieve higher operational availability.

This involves fusing data generated from operations and prior maintenance, covering diverse datasets from sources such as equipment design information, sensor time series data, maintenance records, inspection records, performance reports and class-survey reports.

From this, an understanding of observed failure trends and risks can be gained, which in turn provides the data-driven insights needed to underpin condition based maintenance (CBM).

Subrat Nanda, Chief Data Scientist, ABS

Unlocking unstructured data

One of the largest obstacles to obtaining maximum value from this exercise is that the maintenance history and operator observa-

tional data is typically unstructured.

This limits the achievement of CBM insights to be based mostly on structured parameter sensor data and in-situ or offline tests such as vibration and oil quality.

Part of my recent work has been looking at ways to better unlock the value of unstructured data, usually stored in an operator's computerized maintenance management system, repair and spare logs and other repositories.

A typical offshore maintenance management system allows users to input free-text status reports. Many of the drop-down fields have missing or incomplete entries.

The problem with free-text fields is that they are written in a natural language format. How a person would speak, or using community-specific terminology. This makes it a major contributor to the poor quality of data generally found in a maintenance management system.

Specific examples of data quality issues include non-standard abbreviations used by different operators and crew; inconsistent equipment taxonomy; leaving critical software fields blank due to lack of time or knowledge; common spelling and grammar mistakes; variation in sentence structures used to describe the same situation.

All of this means that datasets must be analysed to extract useful information locked in an unstructured form before further analyses can be performed – a process which can be the difference between uncovering a systemic problem and letting it slip through the net.

AI for unstructured data

Historical maintenance records have been used to train artificial intelligence algorithms capable of working with unstructured free-form data to automate the task of identifying maintenance action types, differentiating maintenance scope and also isolating maintenance triggers.

This results in faster, repeatable and more accurate analysis, leading to being able to identify emergent issues, and model the reliability risks in an asset fleet.

This formed a key part of our recent studies, which involved developing advanced methods to perform natural language processing customized to the unique problem domain of marine machinery & equipment maintenance.

We concentrated efforts on measuring, identifying and improving data quality issues. This involved building models to perform automated annotation via various machine learning techniques.

Several models using different hypothesis spaces and relative strengths were tested for building model ensembles. These included randomization-based methods, kernel-based techniques, probabilistic models and instance-based learning ideas.

Following this work, we now have generalizable, accurate and automated modelling processes to extract insights from otherwise unstructured and free text information, coming from the domain of diverse marine and offshore assets.

In so doing, we have also developed a set of artificial intelligence methods to address the data quality challenge posed by unstructured operations generated data sources.

It facilitates faster and more reliable data processing and provides robustness against variations in expression of semantics which are commonplace in marine and offshore working environments.

It grants the ability to perform data fusion, treating multiple sources of data as one as opposed to in siloes.

Condition based maintenance

Condition-based maintenance (CBM) is a maintenance strategy that dictates decisions about what work needs to be carried out based on the actual condition of an asset.

Under CBM, maintenance should only be performed when certain indicators are triggered and when it is economically optimal.

In other words, it should be done when there are signs of decreasing performance or upcoming failures. The maintenance should be performed at a time or location which makes it optimal from not only technical but also safety and economic perspectives.

The need for CBM arises in part due to the challenges of time-based maintenance practices, as well as a need to reduce uncertainty during maintenance events, and requirements to safely extend the service life of equipment to achieve maximum availability.

Condition-based maintenance is not a replacement for subject matter experts (in fact, CBM relies on their input to train and utilize their experiential knowledge to guide improvements). Rather, it is a methodology to inform maintenance strategies.

Such information is only valuable if the data fuelling CBM is of high quality – this is where data science comes in.

Quality maintenance data (and thus improved analytics over time) can inform other fundamental business operations such as human development and training.

For equipment manufacturers, it can highlight common faults on the production line, or identify equipment issues before they go on to become widespread across the deployed fleet.

Digital.ai – keeping hackers out of mobile apps

The apps which many oil and gas companies make, to provide their staff with sensor data, can also provide a pathway for hackers. Digital.ai has some tools to keep them out of mobile apps

Digital.ai, a company based in Burlington, Massachusetts, has services and software products to help oil and gas companies manage apps they build, to ensure that they cannot be accessed by hackers.

It has a number of oil and gas industry customers, mainly with apps providing data from sensors.

Managing security of apps is a big challenge for oil and gas companies, because once software is in operation, the software creator can have no visibility of how it is being used, or ability to control or manage it.

The apps are often developed by outside companies, and can be widely distributed, including to outside contractors. And the security risks are often not well understood, says Paul Dant, Vice President of Product Management, security with Digital.ai.

Reverse engineering

One of the biggest dangers with apps is that a hacker can open up the code and see it directly. The app code contains digital instructions for how to communicate with corporate data systems, because someone would use the app to engage with corporate systems. Once a hacker can see the code, they can build a new app which can interfere with corporate systems in a malicious way. This is known as "reverse engineering" – based on taking apart a finished product.

For example, whoever designed the Stuxnet hacking software must have had access to the code, which was running Siemens turbines, in

order to write code which could interfere with the turbines, Mr Dant says. (Stuxnet was probably written by a government department, not a hacker, but the same concept applies).

Hackers who find bugs or holes in software which are then exploited by viruses, are probably also using reverse engineering, he says. It is very hard to find the holes without being able to see the code.

There is not normally any direct way to see the source code for apps, but hackers manage to do this by using what is called "jailbroken" mobile devices, a mobile device where someone has worked out how to bypass various restrictions placed on users. For example, a restriction on Apple phones that they can only run apps downloaded from the Apple store.

These "jailbroken" devices can also let people see the code directly, Mr Dant says.

Other threats

Another way to hack a mobile app is to understand that many apps consist of JavaScript frameworks within a web browser, Mr Dant says.

If a hacker can gain control of this JavaScript framework, they can control what the app sends to the corporate server.

Some security controls within an app are just a flag in a database, for example, whether or not the app thinks its code has been accessed. By changing this flag from 1 to 0, this control can be overridden.

Making apps secure

A first step to making secure apps is to control where they can be downloaded from.

Digital.ai is able to provide a platform which can work as a "private app store".

This means you can direct your employees and contractors to a single place for downloading the apps, with no means of tampering with the code before it is downloaded. You can also ensure that no hacker is able to download the app themselves (and then potentially interfere with the code).

Then, Digital.ai can add features to the apps, which cause the app to automatically shut down, or repair itself, if suspicious activity is detected.

It can obfuscate the source code, so it is very hard for a person to read, although a computer can follow it. It can implement deceptive code patterns, which deter or confuse hackers.

Awareness of risks

Many oil and gas people do not have a clear understanding of where the biggest cyber risks are, Mr Dant says.

Paul Dant, Vice President of Product Management, security with Digital.ai.

One example of the kinds of risks oil and gas companies face was in a news story in Feb 2021 about a hacker who gained access to a Florida water treatment system, Mr Dant says.

The hacker accessed the system via a TeamViewer login, which had been set up but not used for months. TeamViewer gives someone remote access to a computer. If this computer can be used to access the water treatment systems, and if you have remote access to it, you can also access the water treatment systems remotely.

It is not known how the hacker knew about the existence of the login and obtained the password. But we can guess – perhaps a departed employee had some involvement.

Once the hacker had gained access to the water treatment system, the hacker adjusted the level of sodium hydroxide in the water to 100x its normal levels.

The water company engineers only spotted the hack when they saw the mouse cursor move on their computer without moving the mouse themselves, indicating that someone else had control of it.

"If we don't understand what the risks are then we are kind of lost," Mr Dant says. "We're completely blind to these attacks."

"If we just buy more security protection products, we can't be sure we're addressing the specific problems we need to solve."

Long time periods

Some hacks happen over a long time period, perhaps a number of years. The hacker may reverse engineer an app, and then have a tool available to them, but which they do not use, to access corporate systems at some point in the future.

If the initial hack is not detected, "it leaves us with a huge blind spot," Mr Dant says. "It ends up with us having to deal with the attacks once they've made their way to the front door. Now they are hitting our API endpoints [so getting access to other software applications] or hitting our server endpoints."

OT security

Operations technology systems themselves can have security issues which are poorly understood, he says, and this can be exacerbated if there are security issues in the apps which access them.

Mr Dant recalls an experience working with a drilling company, which had equipment powered by Windows devices. Antivirus software flagged a false positive on the Windows software. This caused an interruption to the computer's operation. "It sent a component flying into the air," he says.

"There's a lot of sensors which are running very old software. They have a role in the system where it makes it difficult for them to be turned off to be updated. Any error or fault can result in something catastrophic."

"We see these very vulnerable outdated systems created in the absence of some of the knowledge and practices that we have today."

Where it is hard to update the actual sensor software, "our next best step is to secure the systems that are communicating with the insecure systems," such as mobile apps and servers.

"It comes down to building secure software and keeping it secure," he says.

Provided by software

Digital.ai's security services are unusual in that its product is primarily a software based platform, paid for by subscription, rather than access to a (human) security consultant.

A service which is itself provided through software can be less expensive than a service provided by people charging expensive hourly consulting fees, so long as it works.

Digital.ai has a wide range of tools for mobile applications, to help build secure software and keep it secure when it is running.

It also produces algorithmic tools which aim to estimate the risks and their severity, associated with any given change.

"Zero trust" in oil and gas cybersecurity

David Greenwood of oil and gas IT service provider ISN Solutions advises three "zero trust" principles for cybersecurity. Have a zero trust model, zero trust as a company philosophy, and zero trust of any devices

By David Greenwood, managing director, ISN Solutions

There are three key zero trust principles to ensure IT systems are protected. Having zero trust models, having zero trust as a company philosophy, and zero trust of any devices.

These principles can mitigate risk to company operations and sensitive and critical data.

Over the course of the pandemic, businesses of all genres and sizes within the oil and gas sector have faced increased risk of a network breach.

Hiscox's Cyber Readiness Report (October 2020) revealed that the energy sector (in the UK) bore the highest burden for financial losses as the result of a breach.

This, coupled with the continuation of widespread remote working, has accelerated change in IT infrastructure design, including increased implementation of zero trust security models.

Zero trust models

The underlying ethos to zero trust security models is the assumption that any attempt to access the company network is a potential breach.

In comparison, outdated 'trust but verify' security models assume that the user should be granted access, but ask for verification (usually single factor authentication such as a username and password) 'just in case'.

'Trust but verify' security models pose potentially costly risks, as threats like banking Trojans can capture login credentials, even if data is hosted in the cloud. So these models are no longer a valid defence against modern cyber threats.

The zero trust security model takes verification multiple steps further. The model incorporates stringent security protocols, with multi factor authentication as a minimum, as well as inspecting and logging all traffic.

Access requests originating on a local area network (LAN) are treated with the same level of suspicion as if they had come from a wide area network (WAN) which in IT security terms is analogous to the Wild West.

This is because the need to defend against threats from inside companies is being increasingly recognised.

Hackers are turning to bribery (of employees) to access systems and disrupt operations.

As long ago as 2012, in the case of oil and gas company EnerVest, a disgruntled employee was able to sabotage company systems which resulted in extensive disruption to business operations for well over a month. In today's ever more aggressive cyber environment the threats are even greater.

Security models that analyse additional factors beyond user credentials, such as the user's location, device and access habits, and are able to spot anomalies, can more reliably ascertain whether the user is who they claim to be or whether there is a breach.

This enables quicker response to potential threats, and the quicker a response to a breach, the easier it is to limit the damage. This can also help companies to react to insider threats, if the model is designed to flag unusual user activity or login times.

Additionally, in zero trust security models, user access to data is controlled by what is termed as just-in-time (JIT) and just-enough-access (JEA) principles.

These ensure that employees can access the data they need to stay productive. But access to other areas of data and areas of the network are restricted to limit the scope of damage from a successful hacking attempt or malware or ransomware infection, thus preventing infection spreading across the rest of the entire network and all devices.

Zero trust philosophy

The principle of 'never trust, always verify' shouldn't just be applied to IT systems design, but should be fully integrated into company culture.

Some scams and attempts at data theft, such as business email compromise (BEC) scams or malware posing as systems or browser updates, rely on social engineering tactics rather than forcing entry to the company network. These can be particularly difficult to defend against as these scams are triggered simply by human error.

As theft of information is one of the primary motives for attacks against energy companies, BEC represents a potentially serious threat. Hackers may try to obtain company plans on mergers, acquisitions or bidding strategies to sell on to a competitor, for example.

In this scam, hackers spoof an email domain

David Greenwood, managing director, ISN Solutions

to very closely match the email address of a company's CEO or senior management, and distribute an email asking for sensitive information to company employees. The scam relies on employees being too busy or stressed to properly examine the sender's email address or register the request as unusual.

The potential of these scams succeeding has grown under the stress of the pandemic.

Falling victim to a BEC attack can have wide-ranging consequences. As well as sensitive company information being passed to competitors, there is also the potential of cancellation of business deals, and loss of revenue, reputation and customers.

Zero trust of devices

The golden rule of IT security is that there should be no single point of failure, which includes ensuring that no unvetted, unsecured devices can access the network.

This is vital to the oil and gas sector in particular as it continues to undergo digital transformation and equip employees in offshore and remote locations with small, portable devices to access critical company data.

The problem with introducing these devices to company networks is that it's often forgotten that they can create an entry point for hackers. The most obvious threat is ransomware, which has the potential to spread quickly from one infected device across an entire network.

Ransomware

It can take weeks until companies are able to resume operations as normal after a ransomware attack, and the cost of a ransom is likely

to be high, especially now as ransomware operators are deploying two-stage attacks, demanding a second ransom with the threat of publishing sensitive data online.

The potential cost of ransomware attacks today goes beyond severe financial loss. It includes damage to existing customer relationships and severe difficulty attracting new business, especially if it's discovered that customer data has been published online.

While enabling multi factor authentication on VPN services and having endpoint security solutions can help to prevent ransomware operators from accessing the network, the key defence against ransomware is to be prepared.

This means proper backing up of data in multiple locations, which can help companies to avoid paying a ransom and to resume business operations more quickly, and ensuring there are no unsecured end-points leaving an easy way in for hackers.

Switching to a zero trust security model often requires careful planning to ensure productivity and access to data needed for daily work is maintained. If needs be, companies can partner with an IT MSP specialising in network resilience and security to advise on, or assist with, the implementation of new security architecture and protocols.

How BSM manages vessel performance

Managing vessel performance for a large fleet involves developing the right management systems, not just getting an understanding of individual vessels. We spoke to Bernhard Schulte Shipmanagement (BSM) about it

Bernhard Schulte Shipmanagement (BSM) manages a fleet of 600 vessels, including over 170 chemical, product and crude tankers of all sizes. For BSM, managing vessel performance is not just about understanding individual vessels, it is about managing the whole fleet.

We spoke to Frank Paleokrassas, head of Data Governance & Analytics with BSM, to find out how this works.

BSM has established a centre of excellence / expertise for vessel performance, which focusses on building tools and systems, staffed by vessel performance specialists.

But the actual responsibility and accountability for vessel performance is taken by the people who make day to day decisions about how they are operated. Such as the technical superintendents and other members of the "fleet teams".

It means that the focus of the vessel performance specialists is on building tools which can empower decision-making and allow the fleet teams can use "to manage the performance of the ships by themselves," Mr Paleokrassas says.

In addition, the company has a network of 12 "performance leaders", each supporting the performance of 36 ships in their offices. The performance leaders are a "network of experts that act as a channel for communication."

Frank Paleokrassas, head of Data Governance & Analytics with BSM

These people also gather feedback from the fleet team members who are using the tools, so they can be continuously improved.

The tools are continuously refined, to gradually increase the amount of explainability and interpretability they provide, to people who are not performance professionals.

Many large shipowners have taken a different approach, taking performance management responsibility away from the day-to-day fleet management team, and making it the responsibility of a centralised performance team. "This is against our principal way of thinking, against our overall strategy," he says.

Measuring performance

The company developed KPIs which could be used as an objective description of performance. "We are able to get a single number representing the performance of each ship," Mr Paleokrassas says.

It produces a pyramid of KPIs, which ultimately roll up to a single number for the ship, and then a single number for the fleet.

This gives the whole company visibility as to whether the situation is improving, and how fast.

The superintendents themselves can be given a vessel performance score based on the vessels they are looking after.

Over time, BSM may wish to adjust the weightings that the various components contribute to the final score, as different areas may become more important.

Further dimensions are being added to the system.

The digital twins built for every ship in BSM's fleet was used as a basis for calculating the vessel's EEXI (Energy Efficiency of Existing Ships Index). The company already produced preliminary EEXI figures for its entire fleet back in January and now awaits the regulation to be finalised in June.

EEXI only covers the vessel design itself (basically, its fuel consumption per ton miles, under reference conditions). Aspects of the operation, such as routing, are not covered.

EEXI is everyone's headache right now," he says. "There's a looming deadline, 2023."

The CII (IMO's Carbon Intensity Index) is also coming into play at the same time, (a requirement to report the carbon emissions per unit of transport work). BSM's fleet operational data will be used for CII reporting, pending finalisation of the exact regulatory requirements.

Data reporting and analytics

The primary source of data input is still manual reporting, such as in the noon day report. Automated data collection / telemetry, where available, is in addition, adding a level of granularity.

There is a wide diversity between vessels in the company's fleet, of what sensors and other equipment they have onboard. The fleet includes ships with different sizes, types, propulsion arrangements, machinery arrangements, and now some with dual fuel, adding to the complexity.

"We have to account for every single ship in our fleet irrespective of its age and type," he says.

Presentation of the data is also very important. "For me, everything that we do here must drive decision making in the most objective manner possible. In order to do this, the information presented must be simple and clear."

One way to simplify is to set a benchmark, or point of reference, and then people can see if they are ahead or behind it. Or to show things as simple percentages.

BSM has reached a point where it can make a static comparison of a ship's performance with what would be expected, based on its digital twin.

"Unless you embed explainability into technical analytics, you always need time and functional knowledge to understand what you're looking at Is it positive, is it negative?"

Data quality is critical to all of this. "It has been my personal quest to improve our data quality over the last few years," he said. "We do implement further and further measures to improve."

It needs an understanding that data is never completely perfect, so if your operation data quality is low there is a level of uncertainty and risk in any decision made using it.

Sharing data

BSM is exploring ways to make data transparent and readily available to customers (shipowners), which they can pass on to their own customers (charterers). There are often hurdles or complications which come up in discussions about doing this, but "I think this will be the way going forward," he says.

Shipowners and charterers often spend large amounts of time in discussion about the amount of fuel used by a vessel in the voyage, and charterers make claims when they believe it has been overconsuming. But this discussion ultimately achieves very little in the goal of decarbonisation and achieving better operations, he says.

Some owners and charterers are asking for more granular data about vessel performance than daily (noon day report).

Shipowners can also use the data to help make decisions about spending on energy saving devices, sensors and other equipment for the ship. As a third party shipmanager, BSM does not make such decisions itself, instead proposing expert recommendations to its customers

The data can also show shipowners how their vessel ranks with other similar vessels in the fleet.

Digital technology

All of BSM's performance data is managed in a single software system.

The software separates data about voyage performance (such as hull and propeller maintenance) and machinery performance (operation of the main and auxiliary engines, power management, lubricants), rolling the data up to make a KPI for each.

Bernhard Schulte Shipmanagement maintains digital models, or "digital twins" of all of the ships in its management, which also include information about how each vessel is expected to perform. So far this data is drawn from the ship's dimensions, machinery characteristics, shop tests, model tests, sea trials and hydrostatic data. The scope is continuously expanding.

BSM's sister company, MariApps, has developed its own corporate resources planning system, "SmartPAL", described as a complete ship management software.

In 2019, BSM embarked on a joint venture with a Finnish company called Navidium, to build technology to help gather data from vessels, acting as BSM's preferred vendor. It has installed telemetry systems on 50 ships so far. The vessel data is provided on a minute by minute basis.

BSM is also building its own weather routing and voyage optimisation system as part of its joint venture with Navidium.

There is a big focus on developing predictive and prescriptive analytics tools, to try to predict what will happen and how problems can be avoided.

BSM expects to be focussing in 2021 on "edge analytics", doing analytics processing onboard the vessel, rather than taking all the data to a central data centre for processing.

This means that the results of the processing can be made available directly to the crew, rather than communicated to the crew by the superintendent. With shore processing, "the superintendent has to go back to the ship to advise them on what needs to happen. This introduces a degree of delay."

"We are moving towards doing all of this analysis onboard. Basically we're going to use the same algorithms, with some small computers. It will give up to the minute advice to the people that are able to affect optimisation, i.e. our crews."

Market incentives

In terms of the market incentives for the efforts, Mr Paleokrassas says that for ship managers, there are rarely any carrots (rewards for achieving higher performance than is required). Normally it is just sticks (complaints about targets not met).

Many schemes, including the Poseidon Principles, are ultimately only about ensuring that the vessels comply with regulations, such as the decarbonisation trajectory required by IMO, he says.

This means that when the company considers a decarbonisation project which may take a large investment, there are no clear ways to recoup this, such as from shipowners or charterers. "There have always been discussions [about market rewards], I have never so far seen them materialise."

Too much data coming from drilling rigs? Filter it

If you have too much data coming from your drilling rigs to sensibly handle, the right approach may be to filter it offshore, a form of "edge computing", so you are communicating a much more compact data set. Dale Kim of Hazelcast explains how it can work *By Dale Kim, senior director of technical solutions, Hazelcast*

At any given time during drilling, huge amounts of data are created that exhibit subtle patterns that can help make useful predictions.

IT teams have regularly faced the challenge of acquiring and analysing very large quantities of data generated by rigs' sensors.

Rigs are loaded with sensors to detect the smallest changes during these processes.

At any time, up to 60 to 70 channels of high-frequency data enter the customer's network at various frequencies.

Without a system to rapidly process, store, and analyse all that data, engineers face a high level of discarded information and more worryingly, critical events are not met with proper responses.

Traditional methods of collecting data, by physically delivering storage devices to a central data centre, are sometime used. This avoids the obvious challenges around sending huge volumes of data across the network from remote locations with limited bandwidth.

But this is far from real-time, which leads to missed opportunities, and is extremely inefficient compared to a more digital approach.

Rig operators want to know when to adjust drilling angles, to understand if the equipment soon needs repair or replacement, and to decide what action to take around oil depletion, all in real time.

Energy firms' executives are pushing for greater data insights from drilling; they are asking for "dashboard" approaches with real-time visualization and interpretation of data, to help meet more sophisticated operational

Dale Kim, senior director of technical solutions, Hazelcast

KPIs, though they are still missing out on the automated capabilities that stream processing technologies enable.

So, in spite of energy companies having invested millions of pounds in drilling technologies, their IT infrastructures can remain their weak point in understanding their operational data.

Edge computing

The other option is to embrace the pattern of edge computing and push the analytics workloads to the rigs.

This approach needs some proper planning though. With limited space for computing hardware at the rigs, the selected analytics platforms need to be extremely efficient and run on small hardware footprints.

This means you can't use many popular analytics platforms that were designed for large data centres with multi-core servers.

And many software tools today that are designed for Internet of Things (IoT) deployments are not designed for large-scale processing in data centres.

Also, IoT systems have to run 24x7, which puts a premium on reliability since these systems are so difficult to access and refine.

These systems need built-in redundancy, just like in mission-critical data centre deployments, to reduce the risk of data analysis downtime.

Stream processing

An option is to use stream processing tools.

Stream processing can be defined as processing of data in motion – doing calculations on data as it is produced or received.

This means data can be analysed in situ (onboard rigs), and then aggregated and filtered to create a more compact data set that can be more easily delivered to a central data centre for large-scale analytics.

There are lightweight stream processing engines available, which can run complex analytics where the hardware has limited capability.

They have capabilities like replication which ensure continuous uptime despite a failure in a portion of the hardware deployment.

The data streams can enter the firm's analytics data centre, and then fed into analytic engines for further analysis.

Working in this way, one company with North Sea operations was able to do real-time adjustment of the revolutions per minute (RPM) of the drilling bit, and better management of physical resources.

All these adjustments can be managed to the most exacting levels, to prevent equipment failure and potential delays to the drilling process.

Engineers were able to set up defined streaming KPIs for the operation stack, helping to cut the amount of time to drill a well, potentially saving millions of pounds.

Hazelcast is a fast cloud application platform that provides a high-speed, cloud native, distributed stream processing integrated with in-memory storage to power software applications with the highest throughput and lowest latency requirements.

It has been involved in a project with a drilling operator whose operations include North Sea installations. The company has offices in San Mateo (California), Istanbul and London. Dale Kim is the Senior Director of Technical Solutions at Hazelcast.

Blockchain for seismic, ESG, JVs and transport

Energy industry consortium Blockchain For Energy is exploring how blockchain technology is adding value in oil and gas by looking at seismic data ownership, ESG records, joint ventures data and commodity transport.

Oil and gas industry consortium Blockchain For Energy is exploring how blockchain can be used on seismic data, ESG data, joint venture data and commodity transport data, and helping understand how it can best add value.

Blockchain For Energy is a non-profit organization, and its current members are Chevron, ConocoPhillips, ExxonMobil, Hess, Pioneer, Repsol and Worley.

Rebecca Hofmann, president of Blockchain For Energy, explained more, speaking at the PIDX (Petroleum Industry Data Exchange) "2021 Virtual Spring Conference: An Innovative Road-Map for the Industry" event on Apr 28-29.

The core value proposition of blockchain in oil and gas, as Ms Hofmann describes it, is where you have multiple parties working with the same data. The content of the data has financial implications, such as describing who owns something, or whether somebody needs to be paid. And there may be concerns about level of trust between partners, now or in the future. Having an agreed source of truth is a means of avoiding inefficiencies and disputes.

Rebecca Hofmann, president of Blockchain For Energy (photo from PIDX virtual event)

The data does not necessarily need to be fast moving for blockchain to add value, she says. Consider seismic ownership rights. Two parties may agree on rights for usage of seismic data, and sign contracts. Decades later the contracts may be lost, or one party gets acquired. If instead of using paper documents or e-mails, they agree that the record of the agreement is stored forever in a certain blockchain, it can make life much easier.

The vision is to "create this seamless integrated way of working," where once business partners have made agreements, any and all funds transfers can be managed automatically, and records of the transaction easily available, via the blockchain.

Any sales process which happens over a long period of time can have an enormous number of 'touches' (contacts between the parties), disputes and frictions.

Blockchain and 'smart contracts' can provide enhanced value when combined with additional technologies to validate an occurrence and an automatic funds exchange. If one company is repeatedly providing services to another, for example, and making digital records of what has been done at the point of service provision, a system can be set up which automatically transfers the funds based on this record. This then enables the process of purchase orders, approvals, invoices, and payments to be bypassed.

As an example, if an operators data matches (within a certain tolerance) a trucker's data, this validates that a cargo of water has been hauled from a well site, the funds from the well operator to pay the haulier can be automatically transferred. This creates a touchless transaction as the blockchain is trusted and immutable due to the cryptographic properties of the technology.

Blockchain is also safer than a database. It mitigates the risk of hackers taking down the entire system since each participant on the blockchain has an exact copy called a node. This is why blockchain is characterised as a distributive ledger.

In addition, Blockchain could be useful for regulators since it is designed to provide "one source of truth" for data. This "truth" can be provided to regulators and government agencies, providing them with transparency, visibility, and auditability in real time.

Interest in the industry

There is an increasingly large amount of interest in blockchain for the industry. "People are wondering if blockchain technology can be the solution for companies in pursuit of operational efficiency, further automation and increased profitability," Ms Hofmann says. "Forward thinking companies are doing a lot of pilots and we are starting to see the first implementable solutions."

Implementing blockchain is about solving the common pain points between Operators and Oilfield Vendors where the current process is proving inefficient. It's about working out the common interactions which need to happen to agree on a new digital way of working between external parties.

Getting value out of blockchain will often prompt people to work in new ways. The current ways of working, with exchange of documents and databases controlled by vendors, is very different to a blockchain-centric way of working, where external business parties agree in advance to use a decentralized ledger to create a common digital data set.

One of the biggest obstacles to doing more with blockchain turns out to be people, "like you and me," Ms Hofmann said. "People say they are open to change, but in reality, they fear the unknown and want only small incremental changes." This limits the ability for the industry to modernize its processes.

Blockchain for Energy works with companies in many different ways. There are varied levels of interest in the technology, and varied levels of readiness to use it. Some companies are ready to adopt it, whereas others just want to observe what is going on.

"We welcome it all," she said. "We think it's going to create different motivations for each company. My advice would be not to get into long term procurement contracts as innovation and technology advancements are happening at lighting speeds."

Blockchain for Energy has legal and procurement committees, who look at specific use cases to identify how they would work and what would be needed, to enable a 'smart contract'.

Blockchain for Energy could also potentially host a blockchain "node" for smaller vendors and suppliers to help them transition to digital ways of working. This could be a computer which is connected to the blockchain network, which stores a copy of the blockchain itself (not the only copy of course, otherwise it would not be a blockchain), and checks individual transactions as they are made.

What blockchain is

The blockchain technology itself is a backbone. "You don't really see it or touch it. It is the locking of the data that makes it strong," she said. "It is the mixing of additional technologies that creates that overall transformative solution."

There is still a lot of confusion between Bitcoin and blockchain, she said, with Bitcoin getting so much attention in the media. "Bitcoin is an application that runs on a blockchain. Blockchain is the back-end technology that runs Bitcoin."

A blockchain is a backend technology and nodes are stored in multiple identical copies, with all parties having access. Any records, once accepted, cannot be tampered with thus making the data more secure. There is no single owner or controller of the system which is an important aspect of blockchain and distinguishes it from a database which is usually owned by a vendor. If you have a shared data source on the blockchain then it is more accepting to have a shared ownership of the blockchain.

So, if the records in the blockchain which utilize smart contracts are shared and validate how much money somebody gets paid, there is no need to reconcile the seller's database with the buyers. There is only one source of truth, and everyone has agreed on how the data is accumulated and presented.

There are strong security systems, ensuring only authorised parties can transact, and data once accepted cannot be edited.

It would be useful if more people understood these technologies, "so people can see that it is not a big mystery," Ms Hofmann said. Educating the industry is one of the main reasons Blockchain For Energy consortium was established.

Specific applications

The Blockchain for Energy consortium is focussed on getting a better understanding of how the technology can help in four areas of oil and gas operations - joint venture management, commodity transport, seismic data ownership rights, and ESG.

The joint venture management project is for managing data associated with the joint operating agreement between operator companies. Operating companies create joint venture agreements to mitigate risk and share costs of expensive development projects.

This creates issues around obtaining approvals / authorization for expenditures and having to bill out a percentage of expenses to the joint partners.

Blockchain For Energy has identified large pain points, inefficiencies and excess costs associated with this process. There is a common thread of master data which needs to be managed among these external parties. Blockchain for Energy is utilizing blockchain technology to transform how companies can work with external partners and has created The Integrated Joint Venture Management solution which will be at minimal viable product status by the end of 2021.

Currently at implementation grade is the Commodity Transport Project which could be used (for example) for managing deliveries of water, oil or any type of transport. This is a ticketless solution allowing the operator and trucking company to have separate validation points ensuring that what was performed in the field is what is paid for. This was developed in conjunction with a blockchain developer called Data Gumbo.

Ms Hofmann thinks that one of the most interesting applications of blockchain could be to manage records of ownership rights of seismic data.

There are often disputes or lost records relating to seismic data ownership, as data can be needed decades after it was originally bought, or by a company which has since acquired ownership.

Blockchain for Energy has defined the functional and technological specifications for this "use case" and the build starts next month. "The learnings that will come from this use case will be immense and will start opening up the many possibilities like new business models," she says.

ESG may be the most exciting project yet, since it is currently "the hottest topic for all companies because of all the new regulations and all new things going on," she says.

Blockchain For Energy's members have identified a pipeline of potential to leverage opportunities from blockchain technology and it continues to develop and prioritize as members gain agreement. If you want to find out more about Blockchain For Energy you can visit their website at www.blockchainforenergy.net

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