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Open Subsurface Data Universe

The Open Group publishes data sheet for the Shell-backed Open Subsurface Data Universe. Next up is a reference architecture for a cloud-native, API-driven platform for upstream application development.

The Open Subsurface Data Universe (OSDU), a Shell-led initiative from The Open Group has published a data sheet that elaborates on the OSDU's attempt to 'transform' the upstream with a 'standard data platform for exploration, development, and well data.' The OSDU was announced last year by Shell CIO Johan Krebbers. Shell seeded the OSDU with several of its own developments that set out to provide a 'broad, API-driven platform for upstream application development'.

The OSDU Forum is developing a standard data platform for the oil and gas industry, which will reduce silos and 'put data at the center of the subsurface community'. The OSDU plans to deliver a 'reference architecture' for a cloud-native subsurface data platform with initial implementations for Microsoft Azure, Amazon Web Services and the Google Cloud. Application standards will connect the data platform to cloud service providers, software vendors, microservices and proprietary solutions. The common data standards promise 'frictionless' integration and data access.

The solution will separate data from applications and will standardize data formats. The Open Group is to 'involve' global cloud vendors to build working implementations that will allow companies to 'focus on the truly differentiating parts of business activities'. The aim is to 'eliminate data silos and enable seamlessly executed workflows in the cloud from a single portal, taking advantage of powerful cloud-native solutions'.

OSDU operator members currently include Anadarko, BP, Chevron, ConocoPhillips, Devon Energy, Equinor, ExxonMobil, Hess, Marathon Oil, Pandion Energy, Petrobras, Reliance Industries, Shell, Total, and Woodside. Energistics, the upstream data standards body, is listed as one of the 30 or so 'supplier' members. More from The Open Group.

CFIHOS to merge into IOGP JIP33

Capital facilities information handover standard to migrate from USPI-NL to UK's IOGP, opening a new chapter in the long search for construction industry procurement standardization.

As we reported last year, Cfihos, the Netherlands-headquartered USPI NL's Capital facilities information standard initiative shares the same owner-operator members as the UK-based International oil and gas operator's association's JIP33 . The objectives of both Cfihos and JIP 33 also overlap to a considerable degree. Cfihos deals with information handover, JIP33 with procurement specifications for the upstream construction supply chain. Speaking at the 2019 USPI NL Annual Management meeting in Amersfoort, NL, Shell's Anders Thostrup, who is both USPI chair and vice-chair of the IOGP's instrumentation standards subcommittee,

announced that a handover of Cfihos to IOGP was pretty much a done deal. The transfer is still dependent on management committee approval and on agreement on the treatment of Cfihos-owned intellectual property.

The move may have been a surprise for some Cfihos members. Cfihos has dominated USPI activity for last few years. Cfihos has around 50 member organizations including oils, EPCs and software vendors. IOGP is more of an oils-only organization. The two approaches also differ. Cfihos is as an attempt to simplify the decades of work represented by the ISO 15926 constellation of information standards and to provide a vehicle for overarching information handover during a construction project. JIP33 on the other hand produces equipment-class specific narrative documents that leverage work from the American Petroleum Institute and (apparently) ISO 14224. Phase 3 of JIP33, launched early this year to develop member-requested standards for subsea valves, air-cooled heat exchangers and diesel emergency generators. The JIP33 standards documents are available online.

Thostrup explained his approach to bringing the organizations closer together. The different standards bodies tend to work in bubbles with poor communication. Owner operators are starting to take their role more seriously, witness the IOGP's vision for information standards for documents and data in the upstream and a common voice for operators. The IOGP ISSC is orchestrating data standardization through memorandums of understanding with EPIM STI (Norway) CFIHOS and also, Mimosa, PoscCaesar and DEXPI.

Announcing the start of JIP33 Phase 3, steering committee chair Richard Mortimer stated, [with regard to upstream supply chain efficiency], "There is certainly room for improvement. In recent years, 75% of large E&P projects exceeded budget by 50%, with scheduling over-runs of 40%. This has to stop. Standardizing procurement specifications is the way forward*." Already there is linkage between Cfihos and JIP33. In one of the latest JIP33 publications, covering heat exchangers, the information requirements and deliverables are cross-published with Cfihos. We will be reporting from the latest (last?) Cfihos meeting which took place recently in Amersfoort, NL in our next issue.

Similar-sounding statements were made some twenty years ago at the outset of the PCA/ISO 15926 work. Looking back at our report from the 1999 Plant Information Management event in The Hague, we see that at the time, plant information exchange was being proposed via the then novel XML protocol. Today, industry (for both JIP33 and Cfihos) seems to have reverted to good old Excel!

Big Data Paris 2019

Neil McNaughton spends some time at a generic 'Big Data Paris' conference, an action-packed affair with speakers from Audi on connected cars, Mapr on Kubernetes and its own dataware approach, and online betting company Betclic which runs a data warehouse with 1.5 billion records on Snowflake in the cloud. But how these disruptive new technologies might translate to oil and gas is where things get interesting.

It is always a good idea to listen to other industries, especially when they are engaged with initiatives that seem to parallel things that are happening in oil and gas. Hence my attendance at

Big Data Paris organized by the curiously named 'Corp Agency'. This event was seriously busy with a packed exhibition area where vendors large and small pitched to enthusiastic crowds. The multiple auditoriums were likewise busy, with folks pushing to get out against those who were pushing to get in. It was a bit like the Metro.

I managed to avoid much of the bun fight by sitting in on the plenary sessions where I heard Hubert Fischer explaining how VW Group's **Audi Electronic Venture** unit is studying streaming data from connected cars. Data is 'a lot more than the new oil' it is the 'new DNA' for the auto industry. Audi's onboard data collector takes data from the engine, tires, pollution, liquid levels, radars and transmits it all to an 'internet of things backend', aka the automotive cloud. Collaborating fleet cars can broadcast where there is a free parking spot! Real time is key, 'life does not happen in batch'. VW's own fast IoT platform in the cloud gathers data streams from millions of vehicles and performs real time analytics to analyze for black ice/aquaplaning risks. Swarm intelligence provides best route calculations 'displacing service providers' (like Google Maps? … really?). Kafka queues run on AWS for data ingestion. Asked what data volumes come into the system, Fischer stated that VW is not allowed to collect all possible data, 'but if we could, we could have around 4TB from a single vehicle in an 8 hours ride'.

The 'terabytes of data' remark reminded me of GE's extravagant claims for data streaming from its airplane engines that appear to have been largely made-up. If you are 'selling' big data analytics, then you need the raw material of big data. Once you have this you can beat up on folks for not using it. Given that the first use of an in car computer dates back to 1968, when Volkswagen introduced its ECU Computer (Engine Control Unit), and the fact that these have been standard on most cars since the late 1970's, it is reasonable to assume that there is indeed a lot of data buzzing around in an automobile. But most of this emissions control data is already processed on board in real time. It's not really a candidate for the cloud. Other data snippets – like 'hey there's a free parking spot' could be pinged out as a very small message. Good data is not all 'big'.

We then heard Remi Forest from **Mapr** describe a 'Kubernetes and dataware ' approach to big data. Seemingly web server/stateless solutions are 'unsuited' to intensive big data applications such as IoT, mobile, monitoring and analytics and where scalability (100k users up) is an issue. Forest's talk was more hard-core IT with talk of containers and abstraction layers. At-scale management of data leverages Kubernetes and (potentially) millions of containers, 'Google does billions!' If one dies, never mind there are plenty others! Kubernetes keep containers up and running whatever happens. But data management remains a challenge in the world of containers. Data 'gravity', whereby bigger data attracts apps, is a problem. Enter 'dataware', an abstraction layer that 'allows data to be managed as a first-class enterprise resource decoupled from other dependencies'.

I have a hard time relating to this talk of containers and Kubernetes. I'm not sure if they are terribly relevant to oil and gas IT. They seem to be necessary in a world of massive real-time access to computing resources and data. There may be a requirement for such somewhere in the upstream, I'm not sure, but if there is, it would be nice if someone else 'abstracted' all this stuff away!

Which is exactly what happened in the following talk from French online betting company **Betclic**. Camille Reverdy and Christofer Daussion have rebuilt Betclic's analytics from scratch using a Snowflake data warehouse running on AWS along with an on-site Tableau for analysis. Snowflake is a totally managed service with 1.5 billion events in a single table growing at some

20 million/day. But wait a minute, Snowflake is a 'collection of stateless services that manage virtual warehouses, query optimization and transactions' and which appears to be hugely performant. Just the opposite of what Mapr was saying earlier in the day! OilIT.com has a dozen or so references to Tableau, but none so far for Snowflake. Having said that, Snowflake's early growth came from displacing on-premise Netezza and Teradata boxes in various industries including oil and gas, according to CEO Bob Muglia.

We have reported on containers, in particular with our analysis of Docker, the 'next big thing' a couple of years ago. The container paradigm is associated with 'small pieces of loosely-coupled software' provided as microservices. But until there are many such software apps, as advocated in the OSDU, this edition's lead, discussing containers in a world which remains one of monolithic applications is probably putting the cart before the horse. It's interesting but probably a bit too techie for most.

And what of 'generic' technology as opposed to oil and gas specifics. Is it better to leverage off-the-shelf stuff like the Betclic folks have? In the Q&A someone asked about maintaining the Betclic stack. The reply was that in fact, there was not much development involved in the project. That's rather different from those who advocate running a complete Hadoop stack, managing containers and what have you. If something like Snowflake can run your business intelligence, that neatly avoids all the ugliness of the cloud. However, your business may not map to Betclic's. In Jim Crompton and Steve Cooper's new book*, which we review elsewhere in this issue, one reason for the relative failure of 'Digital Oilfield 1.0' was the difficulty of applying generic technology to oil and gas because of its 'domain complexities'. Which raises the interesting question as to how much of today's novel big data technology stack can usefully accommodate the upstream's data niceties.

*A Digital Journey: The Transformation of the Oil and Gas Industry. Cooper and Crompton 2019. ISBN 9781 7918 909 02

Book Review: A Digital Journey: The transformation of the oil and gas industry

Steve Cooper and Jim Crompton's new book traces the failures of 'Digital Oilfield 1.0' and the movement's resuscitation in today's 'digital transformation'. Big data and analytics will fail too unless there is a renewed focus on data management fundamentals, perhaps with the deployment of a master data management solution like EnergyIQ's TDM, used throughout in a soft sell-cum-illustration of the 'fundamentals'. The authors argue that 'things will be different this time'.

A Digital Journey (ADJ): The transformation of the oil and gas industry* by Steve Cooper (EnergyIQ) and Jim Crompton (Reflections Data Consulting) is 'about data and data management in the oil and gas industry'. The book results from survey of data management carried out by EnergyIQ that was to be published as a white paper. Reviewer Crompton felt this was 'too long for a paper and too short for a book'. Consequently, the survey results were expanded to cover data management in the context of the broader, 'digital transformation' of industry. The authors have it that the digital oilfield initiatives of the previous decade are over. These included various enterprise data initiatives that however, 'typically did not result in the

anticipated returns to the business', with even some 'spectacular failures' (they don't say where these occurred). A contribution to the failure of DO 1.0 was the various attempts to 'place [generic] business intelligence tools directly in the hands of users without […] basic data governance and stewardship'. Elsewhere DO programs became 'a technology-focused marketing campaign'. The authors believe that digital oilfield 1.0 is now at an end and that the industry is entering a new phase of the digital transformation which they term digital oilfield 2.0. ADJ is largely an attempt to explain why things are or will be different this time.

One argument defended in ADJ is that, while complete data and interpretation platforms are available (Landmark's DecisionSpace, Schlumberger's Delfi), these leave companies 'beholden to a single vendor and a limited set of consultants'. Operators are 'increasingly looking for best of breed solutions […] from a variety of vendors and industries'. This is tricky because exploration systems are still siloed, many data processes are manual and there is a lack of standardization across industry suppliers. The numerous attempts to address such issues in the past have proved expensive, unwieldy and 'driven by IT rather than the business'. In general, there has been far too much focus on the technology and too little attention given to the people and process side of the equation.

DO 2.0 is now facing another challenge. The digital oilfield evangelists of yore are now turning to the new world of analytics, machine learning, Hadoop and big data. For the ADJ authors, while 'this work is very interesting, it does not address the fundamental challenges'. At this point, ADJ bifurcates somewhat into one track (Crompton's?) that defends the new analytics fields, albeit with numerous caveats, and another (Cooper's?) that follows a more hands-on approach to data management. The two themes are linked with the observation that attention the more prosaic data management theme is a necessary (but often overlooked) prerequisite for the more sexy 'big data' stuff.

The Crompton thread ranges widely and in an entertaining fashion across big data, the internet of things, the digital twin and industry standards to discuss 'what is different this time?' Today, the differences are externalities such as a flat oil price, a reduced industry head count and the need to do more with less, especially in the context of factory drilling in shale basins. The argument goes that 'digital technology has played a key role in the post 2014 return to profitability and will play an even bigger role going forward'.

The Cooper trend naturally turns to EnergyIQ's Trusted Data Management (TDM) platform. This is used throughout ADJ as the manifestation of best practices. Likewise, the PPDM E&P data model is considered the gold standard for describing and managing upstream data. But this turns out to be something of a back-to-the-future development. A large part of ADJ is devoted to master data management as implemented in the PPDM-based TDM and augmented with compelling data visualizations leveraging Esri GIS and INT's well log viewer. The essentials of MDM in the upstream go back a long way, to before the start of DO 1.0 in fact. Back in 2008 in our Data Management 101 editorial we summarized industry thinking on master data management and other fundamentals. The lookup table approach of TDM, containing well identifiers as used in different software products, has been deployed by many vendors and consultants to tie disparate systems together.

The Cooper and Crompton lines of reasoning come together in that EnergyIQ is now deployable in the cloud. It also uses a NoSQL database (ElasticSearch) for documents and big data storage. These are indeed novel technologies, perhaps things that are 'different now' but these novel approaches are, disappointingly, rather poorly developed in ADJ.

A more comprehensive treatment is given to well lifecycle data management. This describes how EnergyIQ has turned the PPDM 'what is a well' pamphlet into a database schema of a well hierarchy, embedded with its TDM lookup tables and unique well ID, the Ekey, so far internal to EnergyIQ. Here again the authors argue against the use of generic technology, 'many companies have tried to build these [systems of record] solutions themselves using a generic ETL tool with limited success because of domain complexities'. The SOR approach is contrasted with a free-for-all data lake.

ADJ observes that the 'big crew change' is now behind us. Today, some 40% of the industry workforce is under 40 years old. This has meant that a lot of industry know-how, or 'tribal knowledge', has disappeared as the old tribe retires. Elsewhere such knowledge is locked away in PowerPoints and conference presentations.

The authors argue that the well lifecycle approach, along with workflow automation, are key to the digital transformation. The discussion of the Ekey include a short history of the search for a global well identifier (GUWI) that in the end failed when the contractor IHS refused to make its identifiers available to the public**.

All in all, ADJ is an entertaining read even if the dual themes of data management and digital transformation remain somewhat disjoint. The authors are correct in arguing for better data management and QC as a prerequisite for the digital transformation, whatever that means. They are also correct in stressing the importance of well metadata and unique IDs. But these are learnings from the earliest days of oil and gas data management. One is left feeling that little has or will change in DO 2.0. This is probably because of the commercial pressures and foot dragging from software vendors and the tendency on the part of operators to listen to and act on the siren calls from the big IT consultants to continually 'disrupt'.

* *ISBN 9781 7918 909 02.*

** *If we may just blow our own trumpet here, the search for a GUWI was first mentioned in Oil IT Journal back in 2004. It's curious that ADJ's authors, both long-time readers of Oil IT Journal, failed to mention this source of industry 'tribal knowledge' since 1996 and still going strong!*

Upstream Intelligence's 2018 Data Driven Drilling and Production Conference, Aberdeen

Amazon's paradigm shift for oil and gas. Equinor's Integrated Operations Center. Blue Gentoo - physics-based modeling and AI for gas hydrate early warning. Dell EMC/Arundo/Wipro's connected digital operations joint venture. Wipro's 'Intelligent Drilling Advisor' and 'explainable' AI. Wood Group's Proevx AI-inspired well integrity data management. RAB Microfluids' 'point-of need' engine oil analytics.

Arno van den Haak presented **Amazon Web Services**' cloud-enabled technologies as a 'paradigm shift' for oil and gas that promises '50% reduction in IT cost, new solutions and different ways of working'. AWS poster child is Shell's co-developed data platform for upstream innovation which has apparently solved the age-old problem of geoscientists spending 'up to 70% of their time finding and collating data'. Shell has migrated its subsurface deep

learning research program to the platform and 'achieved a 3X performance improvement over internal benchmarks'. More from Amazon.

Very large data sets can be shipped on disk via Amazon's Snowball service for delivery to a regional AWS facility and uploaded to client's cloud portal. A more esoteric data collection option is the Insitu ScanEagle drone which can stay aloft over for 24 hours carrying video cameras, large format still imagers, lidar and other signal detectors. Live information is streamed to the enterprise operation center for real-time monitoring and information sharing with other operational functions.

Another AWS client is BP downstream which has ported its Schneider Electric Spiral Suite linear programming software to the cloud. For some reason, BP, 'couldn't take full advantage of the software's potential power while running in its on-premises data centers'. The move to the cloud means that Spiral Suite analytics are now executed 'in minutes, not hours' and now provide a single source of truth for worldwide company data. More from Amazon. van den Haak concluded saying 'We are at the dawn of a new era which requires a new way of working. It will be digital. The cloud is the new normal.'

Comment: While this may seem rather obvious, 'digital' is certainly not 'new'. Back in the 1970s, seismics was digital, well logging was digital and digital GIS was starting too with Intergraph's dual screen monsters. Widespread use of 'digital' in the office environment began back in the early 1980s with the arrival of the IBM PC. Even the cloud is not really new. Our first encounter with a cloud-based solution for oil and gas was in 1999 with our visit to the GeoQuest PowerHouse.

Bernt Tysseland presented **Equinor**'s new Integrated Operation Centre. The IOC vision is to safely produce to the limits, to prevent breakdowns before they happen and enable remote support from experts in production optimization and predictive maintenance. The IOC acts as a data hub for time series data coming in from offshore platforms and routed to Equinor's cloud-based data platform. A monitoring and support dashboard offers machine learning smarts and 'clear, common targets' for a multi-disciplinary workforce. The overarching philosophy for the IOC mode of operations derives from the Gemba Walk lean management approach. Equinor's Decision support tools include one of the widest screen Excel displays we've ever seen, showing Petex' OpenServer well surveillance solution in action. Those interested in Equinor's data acquisition should checkout Alfonse Reynes' exploration of the now public domain Equinor Volve data set.

Chika Uduma outlined how **Blue Gentoo** combines physics-based modeling along with artificial intelligence in its HydraSens gas hydrate early warning system. Despite best efforts at improving software for simulating fluid conditions in pipeline systems, critical data on inhibitor concentration, water salinity and hydrate formation are often lacking. As industry moves into deep and ultradeep waters, 'every offshore gas well has potential hydrate blockage problems'. Blue Gentoo advocates considering production optimization and hydrate management early in the planning processes. Blue Gentoo's HydraSens 'Smoke Alarm' system for hydrates formation system has been used on Total's Northern Underwater Gas Gathering, Export, and Treatment System (Nuggets) project as reported in SPE 166596.

Chris Lenzsch presented on 'connected digital operations' a **Dell EMC/Arundo/Wipro** joint venture that sets out to deploy artificial intelligence 'at the edge', more specifically with a Dell Edge OPC client running an Arundo edge agent. One use case is the PixelVelocity 'Event Velocity' monitoring technology that ensures that flare stacks are burning, beam pumps

pumping or, using thermographics, can monitor tank levels from outside. Arundo Enterprise analytics also ran in an 'augmented PLC/SCADA' context for pump condition and performance monitoring.

Chris Tolleson (**Wipro**) reported on the 'Intelligent Drilling Advisor' which leverages a DARPA project on 'explainable artificial intelligence' (XAI). XAI aims to create a suite of machine learning techniques that produce more explainable models, while maintaining a high level of learning performance. These will help users understand and trust new AI solutions. Tolleson considers the goal of a completely automated drilling system as 'very important'. Currently, the IDA is a BP-owned patent that exposes AI-derived results to scrutiny. The system distinguishes between measured and calculated values and provides reliability estimates for various drilling parameters.

Dell EMC's David Holmes opined that petro-technical computing will evolve at a faster pace over the next five years than the previous thirty, that expectations of our present and future workforce are changing dramatically, and that technologists 'deserve and require' a seat at the big table. The digital transformation and connected operations will see collaborations between digital natives and citizen data scientists. The balance between vendor-provided and in-house developed solutions, and the relative importance of proprietary and open-source software is a 'conundrum'. Holmes presented an IT landscape with Dell Edge devices feeding a Dell/Boomi Atom hub atop of a Dell EMC upstream data lake.

Simon Copping and James Innes presented **Wood Group**'s Proevx, an AI-inspired extension to Wood's iWit well integrity data management solution. iWit was first developed in 2006 and is used today by 20 operators across some 14,000 wells. The acquired data set provides a basis for analytics and machine learning opportunities such as actuator integrity management with valve signature machine learning. Here, monitoring of supply pressure, function pressure and stroked accumulator volume can provide early warning or failing actuators due to degrading internal components. Proevx was also used to perform regression modelling of Reid vapor pressure at a gas processing plant, derived from 5 years of historical data and some 240 input parameters. The resulting ML-derived model is deployed via Proevx.

Rotimi Alabi presented **RAB Microfluids**' 'point-of need' analysis of engine oils. RAB's technology is a hardware and software bundle that combines physical analysis of engine oils with analytics software. More from RAB Microfluids.

Finally, Graham Gaston presented **Sensalytx**' data analytics and visualization toolset for distributed temperature survey data. Sensalytx' Q-DOS AI-based software for automated event recognition provides a neat color-coded quasi-3D view of DTS downhole data. Q-DOS offers added 'AI in the cloud' and data visualization technology from Fraps.

Aramco's Data Loss Prevention

World Digital Refineries Congress presentation shows how to prevent confidential information from 'leaking' out of the organization with corporate-wide roll out of RSA Data Loss Prevention suite.

Speaking at the 2018 IQPC World Digital Refineries Summit Congress in Kuwait City, Rafiq Khurshid described Saudi Aramco's data loss prevention (DLP) strategy. DLP is the practice of detecting and preventing confidential data from being "leaked" out of an organization's boundaries for unauthorized use. Leaks can occur via emails, removable media, uploading of files to the web or cloud storage, printing out paper copies or using smart phones to take photos. DLP is an 'integral part of a mature security program and a powerful tool for protecting sensitive data'. DLP monitors corporate traffic with content inspection and contextual analysis.

However, DLP is not a 'quick fix' product, but rather a process where implementation is just the beginning. Implementation involves defining roles and responsibilities, accountability and deciding who needs to be informed for each DLP activity. DLP solutions can be both software, or hardware-based but, warns Khurshid, 'Before diving into the technology and available vendor solutions, you should first build a good understanding of what your business requirements for DLP will be'.

Data classification is the first step in a DLP program with the creation of a document classification matrix to establish where the existing data resides and how this data is classified. Documents are classified according to risk of exposure. A DLP governance policy is required and an incident response team trained with defined roles, responsibilities and procedures.

Postscript: Khurshid has been working with Aramco as a DLP consultant and has implemented a corporate wide rollout of the RSA Data Loss Prevention (DLP) suite. RSA's DLP reached an end-of-extended support on the 31st December 2018 and the company announced that 'RSA does not have alternative product or migration recommendations for RSA DLP.'

Software, hardware short takes…

New releases and updates from Yokogawa, Ikon Science, Schneider Electric, Rock Flow Dynamics, Emerson, INT, Esri, ATEK, CGG GeoSoftware, Sercel, Element Analytics, Fieldbit, FracGeo, LMKR, Isatis, KBC, Landmark, CGM Larson, FutureON, Schlumberger, E-Matica, ProcessVision, Quorum Software, Railroad Commission of Texas, RS Energy Group, Siemens, Technical Toolboxes, Vallourec.

Yokogawa has released FAST/TOOLS R10.04, the latest version of its real-time operations management and visualization software as part of its OpreX Control and Safety System family. The scalable scada solution is used in smart IoT-enabled applications and enterprise-wide integrated operations spanning multiple sites and subsystems.

Ikon Science RokDoc 6.6.2 delivers new Deep QI technology, a new portfolio of workflows and solutions that apply machine learning and deep neural networks to subsurface problems.

Schneider Electric has launched Schneider Electric Exchange, a new digital ecosystem for IoT solutions dedicated to solving real-world sustainability and efficiency challenges.

Rock Flow Dynamics has released tNavigator 19.1. More from the release notes.

Emerson has released Roxar Tempest 8.4, the latest version of its integrated reservoir engineering suite.

INT's GeoToolkit.NET Release 3.9 adds new features that empower developers to build feature-rich applications for upstream data visualization.

Esri ArcGIS Pro 2.3 includes a new deep learning toolset for the ArcGIS Image Analyst that supports image classification and object detection workflows. These can leverage a GPU environment setting to use models generated by deep learning frameworks such as TensorFlow, CNTK, and Keras. Also new is a 3D empirical Bayesian kriging tool for spatial data interpolation and prediction. A new LocateXT function automates the discovery and extraction of coordinates and place names from unstructured data such as messages, reports and social media.

ATEK Access Technologies' new TankScan TSU1000 ultrasonic tank monitoring system is a 4G LTE cellular device for remote level monitoring of deployed tanks, totes and containers.

CGG GeoSoftware has released new 'cloud-ready' reservoir characterization solutions. Jason 10.0, HampsonRussell 10.4 and PowerLog 10.0 also feature advanced machine learning capabilities and greater cross-product integration. Emerge now offers 'deep feed forward' neural networks for better prediction of reservoir properties. An open Python ecosystem in PowerLog enables the routine use of machine and deep learning in facies prediction workflows. The new releases already run on Microsoft Azure and will be available on other cloud platforms 'real soon now'.

CGG's **Sercel** manufacturing arm has announced a distributed acoustic sensing seismic solution, SigmaWave. Designed in partnership with **Fotech Solutions**, SigmaWave is dedicated DAS solution for borehole seismic applications that enables continuous, real-time, seismic measurements via fiber optic cable.

Element Analytics has announced the Element AssetHub for cloud-based industrial data management. AssetHub 'integrates, harmonizes and contextualizes time-series data in an efficient, trustworthy and scalable manner, creating a valuable 360-degree view of operations'. 'Code-free' functionality connects siloed data produced by industrial assets, such as pumps and compressors, to enterprise systems and data historians, including OSIsoft PI System and Aspen InfoPlus.21.

Fieldbit believes that its AR/VR-based field services solution is 'ready for take-off' with the release of HoloLens V2. Augmented reality and smart glasses are set to help professionals view IoT data and collaborate with experts to resolve complex technical issues rapidly.

FracGeo now delivers its DrillPredictor completion optimization solution as a cloud and subscription-based web service. DrillPredictor uses commonly available surface drilling data from any contractor to adapt a frac treatment to subsurface geologic and geomechanical conditions.

LMKR's GeoGraphix 2019.1 comes with Gverse NOW, a web-based launch platform for all GeoGraphix and GVERSE applications. Gverse NOW is integrated with the core of Halliburton's iEnergy platform to enable discussions around industry standards and trends. The new release also includes a new Gverse FieldPlanner.

Isatis Neo is **Geovariances**' new generation geostatistics package. Neo adds an intuitive user interface to the Isatis geostatistical engine. A tailored petroleum edition addresses reservoir

modeling specifics and adds workflows for time-to-depth conversion and spill-point and volumetrics uncertainty analysis.

Petro-SIM 7 from **Yokogawa**'s KBC arm sees improvements in full stream fluid characterization methods and thermodynamic models, better integration of utility modeling and rigorous hydraulic network modeling capabilities, including wellbore and subsea production systems. Integration with the OSIsoft PI System makes for a PI Asset Framework model automatically synchronized to the process model, said to be a 'first step toward making Petro-SIM a 'Digital Twin' of the asset'. KBC is also working with IIOT platform vendors on cloud-hosted models.

Halliburton/Landmark has announced the Digital Well Program, a combination of DecisionSpace software components running in Landmark's iEnergy cloud. A microservices-based architecture allows for the assembly of engineering and analytical workflows without the deployment of an entire application. Further customization is available through Landmark's OpenEarth software-sharing community. The DWP combines business process management tools for the automation of internal business processes. A DecisionSpace business rules engine allows microservices to execute business logic.

A new 'VizEx Reader' from **CGM Larson** is to replace the freeware version. The new subscription license will cost a mere $48.00 per year. The viewer has the same functionality, but with some of the restrictions removed. VizEx Reader supports the ISO binary CGM standard versions 1-4, and industry-specific profiles such as Seismic+, Petroleum PIP and others.

FutureON has released 'FieldTwin', a cloud-based platform to realize a digital twin of a subsea field from concept to first oil and beyond. FieldTwin centralizes data into a single source, integrating IoT sensor data into a visual context dashboard for real-time monitoring of equipment statuses, well flowrates and more. FieldTwin is said to connect artificial intelligence and historical data to well-planning, drilling, installation and operations to improve field layouts and concept selection.

The 2019.1 release of **Schlumberger**'s Petrel E&P software flagship and Studio data management platform deliver significant increases in speed and ergonomics. Studio 2019 provides a new way to extract information from the Petrel platform web server, for integration with business intelligence platforms. Petrel and Studio 2019 are available in the Delfi 'cognitive' E&P environment as part of the Petrotechnical Suite providing access to the latest software from a personalized workspace and offering cloud-enabled high-performance computing to optimize workflow execution.

PI Vision from E-Matica is an intuitive web-based application to retrieve, monitor, and analyze OSIsoft PI System data. PI Vision widgets can be assembled into custom displays and shared with other users.

ProcessVision's PV LineVu is a camera system that can be permanently installed on high pressure natural gas systems. Installed downstream of a gas/liquid separator it provides a live video stream of the gas leaving the separator system. Image processing is used to provide operators with a highly sensitive alarm if there is a break-though contaminating the gas stream. Natural gas contamination events can be used as a process control parameter. Up to 48 cameras can be connected to the site controller.

A new version of **Quorum Software**'s Mosaic petroleum economics package includes support for Canada's accelerated investment incentive as proposed in the 2018 fall economic statement. The update enables oil and gas companies to understand the implications of enacting the incentive by running full-cycle economics on reserves and budgets.

The **Railroad Commission** of Texas' Public GIS Map Viewer can now display data for multiple wells in a user-defined radius area. Surface and downhole data on multiple wells can now be downloaded and opened with software such as Microsoft Excel. This feature allows anyone to quickly research information for multiple wells in a specifically designated area, rather than one well at a time.

RS Energy Group's RS Fusion allows clients to blend their own high-resolution horizontal well data with RSEG's clean, analytics-ready public data, into a 'true hybrid analytical data set' that clients can use for modeling and algorithm 'ingestion'.

Siemens has expanded its Digital Enterprise portfolio to include a new digital service for optimizing plant maintenance. The Lifecycle Management Suite facilitates the consistent planning, execution and documentation of service activities. The cloud-based system can be accessed from mobile terminals for immediate documentation of plant activities. The solution is available through an annual subscription, which allows access to the cloud-based modules.

Technical Toolboxes has released Pipeline HUB to integrate pipeline data and facilitate technical work. The HUB connects Technical Toolboxes' library of engineering standards and tools to users' data across the pipeline lifecycle. Integrated maps enable geospatial analysis, visual data reconnaissance and other GIS functionality.

Oil country tubular goods provider **Vallourec** has unveiled a new e-commerce platform Smartengo. The platform holds some 15 OTG references available for delivery initially in Europe and Africa. The platform is set to expand to more Vallourec OTG references and a world-wide geography.

2019 Energy Conference Network Emerging Computing Technologies, Houston

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IOT-eq's 'Toy-Box' blends machine learning and PID control for frac sand delivery. Swim.ai on the 'stateful digital twin' at the edge.

Blake Burnette from **IOT-eq** showed how machine learning can be combined with internet of things edge devices to manage sand delivery during a frac job. This can be quite a complex process as customers have many different types of blenders. The sand hopper may run dry or overflow as the service company speeds up or slows down the blender. Many variables affect the process, frac job design, gate heights of the silo and equipment wear. A good problem set for machine learning. Burnette compared traditional PID-controlled sand delivery with machine learning. ML potentially offers a streamlined solution especially when used as a weighting factor to the PID controller. The problem ML is that it may 'learn' bad habits over time and the process may take too long. Enter IOT-eq's 'Toy Box', a hardware and software combination that provides IoT connectivity to the cloud and a suite of machine learning dashboards that connect multiple sensors, cameras and operators to investigate and optimize ML solutions.

Mark Thompson from **Swim.ai** believes that edge computing is data-driven computing. The problem is that 'databases don't work at the edge'. A database stores information but does not have 'agency', the ability to act. On the other hand, real-world data is perishable, constantly changing and does not fit neatly into a database table. Enter the intelligent edge, that analyzes, learns and predicts from streaming data, on-the-fly, building a stateful digital twin model of the real-world directly from data. This is the technology that is used to control traffic lights and to route vehicles through a city without stops. Such edge-based systems can provide high processing bandwidth at a fraction of the costs of cloud-based central controllers.

BHGE Annual Meeting 2019, Florence

The 2019 BHGE AM was dominated by concerns over carbon and the climate. Plenary sessions highlight the growing role of LNG, 'the magnitude of which is hard to appreciate'. BP trains thousands in 'agile/scrum'-inspired management. Total's 'Gaia' AI for geosciences. Binu Mathew interview. AkerBP on digitizing with Cognite.

Opening plenary

At a pre-conference briefing, BHGE CMO/CTO Derek Mathieson reflected on the first year of post-merger activity which has seen BH's upstream footprint added to GE's mid/downstream activity. In line with other 'green' objectives in the oil and gas industry, BHGE has initiated a CO2 reduction program that targets energy use in turbomachinery manufacturing. A novel 'Lumen Suite' for methane monitoring was announced. BHGE is working with advisors from its wholly-owned Gaffney Cline unit to establish carbon intensity KPIs and accredation of their management and reporting.

BHGE Chairman and CEO Lorenzo Simonelli, speaking early in 2019, warned of ongoing industry volatility and the need to be 'cleaner, more efficient and productive'. A lot is happening in digitalization and IoT and there is a 'democratization' of technology as startups change the landscape. Climate is now discussed in many boardrooms. Of the global 50GT of CO2/year, 10% comes from the oil industry. Renewables are set to grow tenfold out to 2040, 'we need to take this on board'. Simonelli cited BHGE's new technology incubator/energy and innovation center in Oklahoma and a new investment fund. In the quest for lower carbon, gas is seen as a transition fuel out to 2040. BHGE is to reduce its own carbon emissions by 50% by 2030 and to "net zero" by 2050.

Comment: At the risk of stating the obvious, the carbon footprint of the manufacturing process of a compressor is probably rather insignificant when compared with that of the gas it compresses throughout its operating life span.

Energy futures

In the 'smarter energy future' panel session, **Equinor** CEO Eldar Sætre observed that the oil and gas industry 'makes the same mistakes over and over' and 'never prepares for the next up or downturn.' Sætre opined that 'digital is to be truly transformational in the energy transition'. Oils need to join the political and public debate and to 'understand how our behavior is perceived'. There are growing concerns re climate change both from the greens and from investors. Climate change is the most important issue for the future. Human warming is a

scientific fact. Equinor supports the Paris agreement and is to produce oil and gas with a smaller carbon footprint, more wind and the name change (from Statoil).

Mohammed Al Qahtani, SVP Upstream, **Saudi Aramco** begged to differ (somewhat). A rising world population needs reliable, cleaner energy but here the consensus ends. Al Qahtani offers a different narrative of a long, multi-generational transition where it is realistic to expect oil and gas to continue to play a role for decades. Time is needed for an orderly transition 'where no nations are left behind'. Industry needs a more productive dialog with the public around reducing its carbon footprint. Aramco is working on carbon capture and storage and claims the lowest upstream carbon density in the world. Digital technology like artificial intelligence is turning science fiction into fact. Oil and gas has massive amounts of data, 'terabytes per day' from a single gas plant, but currently, only a fraction is used. Machine learning can sift through huge 3D seismic data sets to extract features that are invisible to the human eye. The current climate has had a chilling effect on investment. We need to reverse the trend of lagging investment.

Worldwide LNG Market

A panel session on the worldwide LNG market addressed three LNG sub-markets: established buyers like the EU and Japan (which are not considered a growth area), the major growth markets (China) and 'emerging' LNG markets with small but growing needs. There are also opportunities in bunkering. While supply is currently not an issue, things will change around 2022-3 when supply and new investment will be needed. There are some 500 LNG carriers at sea today. Today, natural gas is still flared in the US due to low natural gas prices and pipeline constraints. Looking forward, the 'magnitude of change is hard to appreciate' with massive investments already committed. Anadarko's Mozambique LNG project is the largest single African investment ever.

Harry Brekelmans **Shell** stated that climate change is society's greatest challenge. We need to provide more and cleaner energy. Shell's 'Sky scenario' meets the Paris goals and provides energy to the world. Shell is reducing its carbon footprint across the board including energy inputs and usage* by 20% by 2035 and 50% by 2050. As an example of how this is to be achieved, the massive Shell Canada Energy LNG export project at Kitimat, BC uses GE turbines and a 'partial use of hydropower' to reduce its carbon footprint*. Shell is also upping its investment in wind, hydrogen and e-vehicle charging stations. CCS is likewise considered a key technology, witness the Alberta Quest project that has sequestered some 3 million tonnes to date.

But same caveat as for GE – this does not reduce footprint on end-use.

Energy transition and oil and gas

Mark Brownstein (**Environment Defense Fund**) puts the oil and gas industry at a strategic juncture. New technology means that fossil fuels are no longer essential to serve some needs. The world is looking for lower carbon energy. Fugitive methane emissions are also problematic, industry must do better monitoring. On the other hand, 'we are terrible at forecasting demand' now at 100 million bopd and growing at around 1 million bopd/year. Investment is not keeping up. The IEA's World Energy Outlook has it that 50% of the world's energy in 2040 will come from oil and gas. For some, digital technologies will enable methane management to be embedded in operations. Using CO_2 in EOR got a plug as a form of CCS. This will have a 'net negative impact' if enough CO_2 is injected into ground. Hydrogen is

'getting important', sourced from methane using 'low carbon energy sources in the transformation'. Efficiency got a plug too. If 2018 was the year of methane, 2019 is the year of efficiency. EDF has launched a competition to find good projects for efficiency.

BP COO upstream Gordon Birrell observed that a rising world population means that energy demand is up. But the Paris agreement means that emissions need to be down. Renewables are the fastest growing source of energy. BP is a long-standing player in biofuels and wind. These represent under 5% and are forecast to be 40% maximum by 2040. For BP, the race is less to renewables, more towards lower emissions, efficiency and 'perhaps CCS'. Birrell warned of low investment in oil and gas, the resulting price spikes and lower standard of living. Today, we live in a world of oil and gas abundance, so 'only efficient companies will win in the future'. For BP this entails modernizing through digital. For example, Plant Operations Advisor*, BP's IoT for oil and gas ingests 150 million data points/day and this is 'just a start, what is exciting is the predictive capability that it could have' (sic). BP claims digital twins of all of its facilities that allow optimization 'in a matter of hours'. Birrel reported that in 2018, POA and the twins 'added 30k bbl/day'.

ENI's Alessandro Puliti said that the world has already used up 70% of the carbon budget needed to stay inside the 2°C scenario. Moreover, forecasts are for a 40mm bopd oil supply/demand gap by 2040 without new investment. A 'sustainable' development scenario relies on negative emissions, removal and sequestration of CO2. This means that the second part of this century could balance the excesses of first half(!). Wind and solar are not good enough. Biomass plus CCS are crucial. CCS needs scaling up quickly. Without widespread deployment of CCS, it will be very difficult to achieve negative emissions in the second half of the century.

Operators

'Demand from millennials' has seen **BP** training some 2,000 employees in Agile/Scrum methodologies. The techniques originated in software development but now BP uses them to solve business problems fast. A small number of specialists work together in 'incredibly efficient' teams. BP also encourages a business ownership mindset, that means 'solving problems as though they were problems in your own family' (presumably divorce is not on the table). Successes here include a record time to FID for BP's Tortue West African gas project and new thinking (and deep ownership) at the Atlantis Gulf of Mexico development which has revealed an extra 400 million barrels. Birrel concluded with a shout out to the UK IOGP's JIP 33 that is to create standard specs for vendors to bid against. Twelve have been produced to date (subsea trees, valves ...) and BP is 'starting to use them on procurement tests'.

* GE's Unified Operations, deployed in POA provide 'holistic insight' into performance of gas compression systems.

Arnaud Breuillac reported on **Total**'s 'Metis' seismic (acquisition concept) currently testing in Papua New Guinea and 'Gaia', artificial intelligence for geosciences, a two year partnership with Google. This will 'delegate low value tasks to an AI assistant such that specialist can focus on high value tasks'. Gaia is be implemented in Total's SisMage flagship. Total/BHGE teams work at real time support centers in Pau and Aberdeen. Breuillac also mentioned Total's 'Drill-X' drilling data analytics project which started in 2018. 'TIM', the Total Industrial Mobility solution has provided ATEX tablets and smartphones to some 1,500 users in 2018. These provide SAP notifications, digitized sites and work orders. Another project, remote assistance intervention and diagnosis (RAID) involves real time monitoring of rotating equipment. Some

260 shaft lines are monitored with 30,000 data points captured and analyzed every 10 minutes at the RAID Center in PAU. Total's AI initiatives are scaling-up in 2019. Total preaches 'sustainable growth fueled by competitive advantage'. Its production costs are lower than peers and declining, to around $5/bbl. Breuillac also reported a 'post-dividend organic breakeven' at under $50/bbl.

Karl Johnny Hersvik described how **AkerBP** is digitizing its business processes with a radical impact on productivity. However, some technologies, like VR glasses, may be great at trade shows but unsuited to the offshore. Solutions need to be actionable. AkerBP's flagship digital deployment is the Ivar Aasen field with a digital platform from Cognite streaming 10 hz data to a data center in Belgium. AkerBP has set up the 'Eureka Program', a digital lab where some 300 projects have been trialed across maintenance, subsurface, HSSE, digital worker, production optimization, NLP and 'semantic' processes. Ivar Aasen is operated from an onshore control room 'while maintaining full manning for offshore operations'. Hersvik says we need to stop talking about data sharing and do it. AkerBP and Cognite have done just that through the OpenIndustrialData real time data showcase.

Interview Binu Mathew

We chatted with BHGE's Global Head, Digital Products and asked if the overarching Predix platform, as announced a couple of years ago, has failed.

Mathew – Predix has evolved. While it is still used in a number of asset-orientated /IoT solutions such as APM and other GE stuff, oil and gas needs more analytics and AI and running at scale.

OITJ – OK, but predix.io was announced as a platform for AI, a whole software stack in fact. There were other IT goodies rolled-in with Predix, microservices, cloud and all that. Is this a return to monolithic apps and point solutions?

Mathew – No, we are bringing all the data together in our Enterprise AI factory. This provides a holistic analysis of plant reliability. Predix looked at assets individually. Enterprise AI looks at the whole plant as opposed to individual pieces of equipment.

OITJ – We heard from Cloudera yesterday, is that the basis of the EAI software stack?

Mathew – Cloudera is a partner, but we have no specific provider for the stack. We work with any combination of public/private cloud at a higher level than Cloudera or Pivotal. We are also working with Nvidia, Microsoft…

OITJ – And with Yokogawa/KBC ...

Mathew – Sure. KBC is still going strong in the process domain. What we are doing is bringing data together to predict failures. Especially those that come from complex inter-reactions of material across the plant. What is key in the information landscape today is the web, that allows for data discovery. Also, knowledge-connected and polyglot storage.

OITJ – So what are the tools you use today?

Mathew – Python, Pandas, TensorFlow, our specialty is Bayesian Networks.

Exhibition

On the exhibition floor we saw a demonstration of artificial intelligence that leveraged System1, condition monitoring software from BHGE's Bently Nevada unit. System1 was driving Yokogawa/KBC's PetroSim to model heat exchangers in a refinery. More generally, BHGE's AI offering is now available from the AI Factory.

Summing-up

We attended the 2018 Baker Hughes GE Annual Meeting in Florence in the expectation of learning more about the ongoing fusion of things digital and mechanical that former CEO Jeff Immelt had embarked on. We were also interested in how the two companies were working together post-merger. Immelt pushed digital – particularly Predix, the first major infrastructure for IoT/AI/ML in the world, to the forefront of GE's activity setting up a large digital unit that looked set to rival the likes of IBM and Accenture. Today, Predix is something that nobody in BHGE wants to talk about (see elsewhere in this issue for our investigation of Predix' fate). Regarding the merger, fusion has given way to a more traditional division of labors. The BHGE Florence event is mainly focused on the old GE Oil and Gas turbomachinery activity. Other facets of the Baker Hughes unit's 'digital' activity will be the subject of a separate 'Unify' event to be held later this year in Monaco.

GE's Predix: An investigation

Back in the days of Jeff Immelt, Predix was set to transform GE from an engineering company into a digital powerhouse. But as GE spins off its IoT software into a new unit and sells out of Pivotal, what is left of the platform?

We have written extensively about Predix, GE's big data infrastructure that according to ex-CEO Jeff Immelt was key to the old GE's digital transformation. Predix previously had two sides to it. A well-defined specification and website (predix.io) and a more nebulous usage across various marketing initiatives. The well-defined Predix was a complete development stack based on the Pivotal cloud-agnostic infrastructure as we reported back in 2013. At the 2019 BHGE meet in Florence, the only clear statement about Predix we heard was "we are not supposed to talk about Predix*".

What has happened? According to a Forbes/Forrester report, GE has spun out its industrial IoT software business into a new GE Digital unit, a wholly-owned subsidiary. Forbes has it that the new unit will include the 'Predix platform' comprising Asset Performance Management (APM) but not ServiceMax which has been sold to Silver Lake. GE initially 'planned to' add Predix functionality to ServiceMax and to 'further the development of additional industrial applications focused on service delivery'. But ServiceMax has its own cloud infrastructure (it uses the Salesforce platform) so this has probably proved to be harder than originally thought.

Which leaves APM inside the new Digital unit and apparently running on the Predix platform. But the extent to which Predix is really running atop of Immelt's original Pivotal stack as described on predix.io is less clear. As reported by CRN, last November, GE sold most of its stake in Pivotal. It would also appear that APM clients may have their own preferred cloud/infrastructure that may not align with the predix.io paradigm. Also, it was Mike Olsen,

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CEO of Cloudera (a Pivotal competitor) who was invited to speak at the 2019 BHGE event. As far as we can tell, Immelt's original concept has not worked out as was hoped. The various corporate level deals around BH, GE and the new digital unit further complicate matters. Perhaps the BHGE folks are not talking about Predix because nobody really knows what is going on.

Postscript: The announcement at the 2019 BHGE Florence event of 'VitalyX' a new cloud-based lubricant monitoring system co-developed by BHGE and the Emirates National Oil Company would appear to be a great candidate for the Predix platform but apparently was developed independently.

* Although Predix is still referred to on the BHGE website as a key component of BHGE's [digital twin](#) offering.

Folks, facts, orgs…

Arria, Atwell, Bechtel, CAM Integrated Solutions, CO_LaN, CGG, Chevron, ClassNK, Cognite, Cushing, Emerson, EMEX, Endress+Hauser, Energistics, ENGlobal, Exebenus, ExxonMobil, EY, Foster Marketing, Halliburton, Henderson, Implico, Landdox, IOGP, Magellan, Marathon Oil, Nabors, NAES, PRCI, Preem, Rose & Associates, Rubicon Oilfield, Ruths.ai, Ryder Scott, Seeq, SkyX, Society of HPC Professionals, Stress Engineering Services, WekaIO, Siemens, XBRL International, Wintershall Dea, Esri, Kosmos Energy, Inpex, APEGA, Fuld, SkyX, XBRL International.

Daniel Kiley is now Chairman of **Arria**'s Board of Directors. Sharon Daniels, who has been serving as both chair and CEO of the company, will continue as a member of the board and CEO.

Emily Cooper has joined **Atwell**'s environmental team as Senior Project Manager. She was previously with Environmental Resources Management. Atwell has also hired Mark Borushko as VP.

James Dutton is **Bechtel**'s regional president for Africa.

CAM Integrated Solutions has promoted Carrie Reoh to lead its accounting department.

Kathryn Yearsley is to replace Mick Lee as BP's representative on **CO_LaN**. Michael Berger is to represent Dow, replacing Isaiah Huang.

CGG's Geoscience division has announced the opening of a new state-of-art reservoir fluids and gas sample storage facility in Schulenburg, Texas.

Chevron has appointed Pierre Breber VP and CFO. He succeeds retiree Patricia Yarrington. Mark Nelson is to replace Breber as executive VP of Downstream and Chemicals.

Hiroaki Sakashita is now **ClassNK** Senior Executive VP and Executive Director.

Cognite is to enter the North American technology market with facilities in Texas and California.

John Alban has been promoted to the new position of CEO at **Cushing**. Jerry Swank assumes the new role of Chairman.

Emerson recently opened a $4 million technology, service and workforce training center to support Permian Basin operators' digital transformation and to optimize operations.

EMEX has appointed Rad Brannan as CIO. He was formerly VP of Business Information Systems at Just Energy.

Endress+Hauser has invested $38.5 million into a new regional campus in Pearland, Houston.

Elinor Doubell (BP) is to succeed Ben Williams as chair of the **Energistics** board of directors. Paul Zeppenfeldt (Shell) and Yves-André Valot (Total) are now members of the board.

ENGlobal has opened a new office in downtown Denver.

Anne Siw Uberg Berge is now VP Strategic Marketing and Business Development at **Exebenus**.

ExxonMobil has streamlined its upstream organization by creating three new upstream companies: ExxonMobil Upstream Oil & Gas Company, by led Liam Mallon, ExxonMobil Upstream Business Development Company headed by Steve Greenlee and ExxonMobil Upstream Integrated Solutions Company which will be managed by Linda DuCharme.

Andy Brogan is the new **EY** Global Oil & Gas Sector Lead.

Anna Scordos-Brooke has been promoted director of public relations at **Foster Marketing**.

Katherine Banks (American Momentum Bank) and Patricia Hemingway Hall (Health Care Service Corporation) are now members of **Halliburton**'s Board.

Billy Rogers is the new president of **Henderson**'s Drilling Products division.

Tim Hoffmeister is now CEO of **Implico Group**.

Landdox has named Alli Irwin as Head of Client Impact. She hails from Oseberg.

Wafik Beydoun is now **IOGP**'s new Regional Director-Americas.

Aaron Milford has been promoted to COO at **Magellan**. He was previously CFO.

Jason Few (Sustayn LLC) and Kent Wells (Fidelity Exploration & Production Company retiree) are now members of the **Marathon Oil** board.

Anthony Chase (ChaseSource) has been appointed to the **Nabors** board.

Tom Bartolomei is President and CEO of **NAES**, a wholly owned subsidiary of Itochu Corporation.

Witland LeBlanc is to succeed Cardon Gerner as VP and Chief Accounting Officer at **Oceaneering**.

PRCI has appointed Natalie Tessel to Director, Brand & Member Engagement.

Lina Stolpe is the new CFO at **Preem** succeeding acting CFO Peder Zetterberg.

Bryce Kalynchuk is now partner at **Rose & Associates**. Mike Forrest has stepped down from an active leadership role. Henry Pettingill (Noble Energy) is now chair of the consortium.

Rubicon Oilfield International opens a new Research and Technology Center in the US to expand its capabilities in drilling solutions.

Mark Zoback has joined the technical advisory board at **Ruths.ai**. He is currently professor of geophysics at Stanford University.

Edward Polishuk is now senior petroleum geoscientist at **Ryder Scott** in Denver. Beau Utley has rejoined the company as Senior Petroleum Engineer. Dean Rietz is now chairman and CEO.

Mike Purcell is MD at **Seeq** EMEA. He hails from OSIsoft.

Sean Carnahan has been appointed to lead **SkyX**'s new downtown Houston office.

Martin Huarte Espinosa (HPE Data Science Institute) is now Executive Director at the **Society of HPC Professionals**.

Stephens Investment Banking has named James Wicklund MD of its energy group. He was previously with Credit Suisse.

Stress Engineering Services has promoted Kenneth Bhalla to CTO.

WekaIO has opened a new office in Houston and appointed Darrin St. Amant as regional sales manager and Jon Lavallee as senior systems engineer.

Pallavi Chelluri is to lead the newly opened **Siemens** MindSphere Application Center in Gurgaon India, a state-of-the-art digital technology center.

Wintershall and Dea have merged in **Wintershall Dea**.

Esri has opened a R&D center in New Delhi, India which will focus on data science, deep learning, and geospatial artificial intelligence.

BrianMaxted Chief Exploration Officer and Founding Partner is to retire from **Kosmos Energy**. He will be succeeded by Tracey Henderson.

Inpex has appointed Hideki Hayakawa VP New Ventures; Shigeyuki Maezumi GM Technical Unit Masela Project Division; Shoichi Kishikaw Senior Coordinator, E&P Unit Eurasia & ME Project Division; Hitoshi Okamura Senior Coordinator, Technical Planning & Coordination Unit Technical Division; Yukihiro Machida Director, Chief Representative INPEX Norge AS; and Shigeru Saito Manager, Perth Office Production Development Planning and Coordination, Australia Ventures.

Melanie Popp, Director, Engineering at **geoLOGIC systems**, is now one of APEGA's new councillors.

Diane Borska is the new CEO & President at **Fuld+Company**.

Ladislas Paszkiewicz is Senior VP Investor Relations and member of the Group Performance Management Committee at **Total**.

Deaths:

Former Chair of the **XBRL International** Best Practices Board, Ian Hicks passed away after a long illness.

Standards stuff

International Data Spaces data architecture, aka 'the engine of the European data Airbus' ready for commercial use. American Petroleum Institute to collaborate with Gulf Cooperation Council standardization organization. Cfihos, the Capital facilities information handover standard, announces Version 1.4. Construction Industry Institute announces new advanced work packaging projects. New OneGeology portal and web mapping service. IOGP launches Phase 3 of JIP33 procurement standard. ISO releases climate change adaptation and greenhouse gas emissions standards. Modelica Association rolls-out standard to connect and assemble models and an API for integrating real-time and offline systems. Open Geospatial Consortium approves 3D Tiles Specification 1.0 and moots geospatial blockchain working group. XBRL explains its new Open Information Model. The Open Group has publishes 'preliminary' O-PAS Standard process automation standard.

The **International Data Spaces** (IDS) Data Architecture has been declared ready for commercial use with the roll-out of the IDS Reference Architecture Model 3.0. The protocol, which has been described as 'the engine of the European data airbus', provides a secure data exchange mechanism for smart factories and energy. IDS provides data sovereignty measures in IoT devices that ensure secure and trusted data communication between mass deployments of networked devices. An 'IDS_ready' certification ensures that an organization complies with the IDS reference architecture and the DIN SPEC 27070 standard. IDS has also produced a position paper on the application of blockchain in the context of international data spaces. Blockchains and distributed ledger technologies are 'suitable, mature, and accepted technologies' for the application in data-driven business ecosystems. The paper was authored by IBM, TNO and Fraunhofer Institute with funding from the EU Horizon 2020 program. IDS currently has data hubs in the Netherlands, France, Finland, the Czech Republic, Italy and Spain .More from IDS.

The **American Petroleum Institute** (API) has signed a memorandum of understanding with GSO, the **Gulf Cooperation Council** standardization organization. API and GSO are to collaborate on standards development, including: the adoption of API's standards, the exchange of information and on increasing knowledge within the API and GSO expert communities.

While its future is somewhat in the balance (see elsewhere in this issue), the **Cfihos**, the Capital facilities information handover standard, is about to issue a new release, version 1.4. This will

include a new data model, a new set of contract documents, a more complete set of equipment types, as well as requirements by equipment type. More from Cfihos in our next issue.

CII, the **Construction Industry Institute** has announced three research projects under its advanced work packaging program. The new projects cover supply chain integration with AWP practices, best practices construction, commissioning and startup, and a new initiative to promote take-up of the AWP as a whole.

A new version of the **OneGeology** portal includes a globe view powered by Cesium ion as well as the standard planar views. The OneGeology portal now offers an EarthResourceML-Lite web mapping service (WMS) and simple feature web feature service provided by GTK, the Finland Geological Survey. The service uses version 2.0 of the 2018 ERML-Lite standard. ERML-Lite 2.0 is an abridged version of the full EarthResourceML standard, an international data model and standard for mineral resources data. Version 3.0 is just about to be released. More on ERML-Lite from the OneGeology cookbook page.

The **International Association of oil and gas producers**’ (IOGP) Joint industry project JIP33 is moving into Phase 3, further standardizing procurement specifications. Commenting the development, BP Group Executive Director Bob Dudley said, ‘I think the idea of everyone having their own designs will soon feel very old-fashioned’. Some 16 procurement specifications have been developed to date and are available under JIP33 Phase 2 for use by operating companies. Phase 3 will see a sustained commitment from 12 major operators working on 30 more specifications including subsea valves, air-cooled heat exchangers and diesel emergency generators.

ISO, the **International Standards Organization** has released standards and guidance related to climate change adaptation and greenhouse gas emissions. ISO 14064-1 for quantifying greenhouse gas emissions and ISO 14067 for quantifying the carbon footprint of products. Other new standards in development cover adaptation to climate change (ISO 14090), impacts, vulnerability and risk assessment (ISO 14091), and green bonds for environmental performance of projects and assets (ISO 14030).

The **Modelica Association** is expanding its portfolio with two new standards. The System Structure and Parameterization standard describes how model components are connected and assembled and how parameterization data is stored and exchanged. The Distributed Co-simulation Protocol standard is an application layer protocol for integrating real-time and offline systems.

The **Open Geospatial Consortium** (OGC) is planning a Blockchain and distributed ledger technologies domain working group. Geospatial standardization of blockchain and DLT may be applicable in land registration and other domains. Read the position paper. OGC also recently approved the 3D Tiles Specification 1.0 for streaming heterogenous 3D geospatial content to clients. 3D Tiles supports 3D models such as point clouds, 3D buildings and BIM/CAD engineering models. The standard addresses high volume streaming data sets such as satellite sensors, drones and autonomous vehicles.

The **XBRL** financial standards organization has published an explanation of its new Open Information Model (OIM), a ‘modernization and simplification’ of the XBRL standard. OIM is a syntax-independent, logical model of XBRL reports than can be delivered in a range of formats, notably xBRL-JSON, said to be ‘the simplest and clearest expression of XBRL reports so far’.

The Open Group has published its O-PAS Standard, V 1.0 a 'preliminary' version of the Exxon-Mobil-backed open process automation standard. When fully defined, O-PAS will enable 'scalable, reliable and secure process automation systems that can be updated without system shutdown'. TOG has also published a glossary covering the new protocol.

The Open Group fleshes-out OPAF, the ExxonMobil-backed open process automation standard

'Preliminary' OPAF V1.0 standard-of-standards set to 'break the chain' of proprietary non-interoperable process device software with a 'brave new world' of certification and conformance.

A blog posting from The Open Group's Ed Harrington provided an update on progress on the TOG/ExxonMobil Open process automation forum, OPAF. OPAF was first floated in 2016 and has now published the Open Process Automation Standard, OPAS V 1.0, a TOG 'preliminary' standard. OPAS is described as 'standard-of-standards' that embeds ISA 62443 (security), OPC UA (communications) and DMTF Redfish for systems management. OPAS V1.0 is available from the TOG library.

OPAS sets out to 'break the chain' of proprietary non-interoperable process device software with a set of standard interfaces that will enable a 'plug-and-play' environment, 'rather than being tied-in to a single vendor.' OPAF has representation from several verticals, in particular oil and gas and petro-chemicals. Later in 2019 TOG is planning an interoperability workshop to test drive the emerging standard. On the drawing board is OPAF V2.0 which is to address 'configuration portability'. The Forum is also working on a conformance certification program and a procurement guide to help end user organizations and systems integrators specify requirements. Harrington opined, 'These are needed because a lot of this stuff is going to be a brave new world for industry participants'. See also the OPAF business guide.

Fiber optic sensing developments from Energistics and OptaSense.

Proposed mods to ProdML add HDF storage for raw sensing data acquisition. OptaSense leverages existing fiber networks in 'opportunistic' monitoring of earthquakes and ambient noise.

In a recent webinar, Wilfred Berlang (**Shell**) and Laurence Ormerod (**Energistics**) argued for a standards-based approach to digital acoustic and temperature sensing (DAS) data management. Raw DAS data can be in the terabyte/day/fiber range. The authors propose an HDF file storage model for both raw and processed DAS data along with metadata stored in an extension of ProdML's XML protocol. The protocol has been in development over the past five years and is currently in real world use. Most recently, a new group is working on using the Energistics Transfer Protocol to stream real-time DAS data. This technology is designed for remote, live monitoring of frac jobs.

In a separate presentation, DAS specialist Martin Karrenbach (**OptaSense**) showed how fiber networks can be used in an opportunistic fashion to monitor earthquake activity and ambient noise. Fiber networks such as those used by telephone companies or pipeline operators can be repurposed to capture earthquake signals or ambient traffic noise. One elegant example is the Big glass microphone, a fiber network deployed at Stanford university that shows, in some detail, traffic, footfall and even a water fountain on the campus. BGM is a joint venture between Stamen Design and the Victoria and Albert Museum.

OpenModelica Association 2019 Workshop

Modelica's systems of systems approach potential candidate for oil and gas digital twins. ABB leverages protocol to drive Optimax models. Latest release adds interactive control of simulations. Modelicon demonstrates model-based drone/robot controller.

In these days of digital twins, one technology that may prove useful to the oil and gas vertical is the Modelica environment. The tool has been used in the past (by ENI) to model systems of systems in the context of an offshore oil and gas production platform. Peter Fritzson provided an update on the OpenModelica association's work at the 2019 Annual Workshop. OpenModelica is an open source environment for modeling complex physical systems. At the 2019 event, the approach was used in a similar context by **ABB** to drive its ABB Optimax model-based control products for power generation and water utilities. OpenModelica provided 'outstanding' debugging features that save time during model development of this large industrial use case.

The latest edition of the software adds interactive simulation and control of simulations with OPC-UA, parameter-based sensitivity and robust optimization. OMSysIdent system parameter identification provides parameter estimation for composite models using the Google-developed Ceres solver. A 'ParModAuto' parallelization module provides automatic tuning and parallelization of equation-based models and automatic task clustering and load balancing. Current industrial users of OpenModelica include ABB Optimax (generating code that controls almost 10% of German power production), DHI, Bosch-Rexroth and EDF. **Modelicon Infotech** has used the toolset to develop a model-based controller for UAVs and robots. More from OpenModelica.

Schlumberger to 'open source' core components of its E&P data ecosystem

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Schlumberger CEO Paal Kibsgaard, speaking at the 2019 Scotia Howard Weil Energy Conference described navigating 'deepest and longest' downturn. A 'long overdue' modernization program sees deployment of state-of-the-art SAP-based IT framework. Cloud-based Delfi platform for upstream software and new 'digital hardware framework' cited.

Schlumberger CEO Paal Kibsgaard, speaking at the 2019 Scotia Howard Weil Energy Conference, reported than since 2014, Schlumberger has navigated the deepest and longest service industry downturn on record. Throughout the nine years since he took office, Schlumberger has implemented a strategic roadmap that includes an overdue modernization of its operating platform. While Schlumberger has successfully driven innovation and performance for its customers it has lacked focus and investment in a similar innovation and performance platform for its own activities. According to Kibsgaard, this has impacted Schlumberger's ability to translate the value created by our people and technology in the field into 'optimized bottom-line results'.

Since 2012, the company has modernized its internal workflows, IT enablement and organizational structure, using best practices from leading companies in other industries. This includes supply chain, sales, maintenance, planning and product and service delivery. The 'long overdue' modernization program was of unprecedented size and complexity and has meant 'rethinking of all our activities and workflows'. Key to the new system is a six-year long investment in an SAP-based, state-of-the-art IT framework. Components of the framework have been piloted in parts of the organization and will be rolled-out in North America in 2019, and subsequently, the rest of the world. Schlumberger is also evolving its management approach to become more collaborative and team based and to 'directly appeal to our growing number of millennial employees, who already make up 55% of our workforce'.

In the E&P sector, Kibsgaard reported that Schlumberger's technology platforms are now 'built on top of Delfi', the new, cloud-based data and software environment, 'a secure collaboration workspace for all our E&P workflows'. Alongside Delfi is a 'digital hardware framework', with a clear set of design guidelines for Schlumberger's hardware product developers. Finally, 'In 2019, we intend to open source core components of our E&P data ecosystem, in collaboration with cloud providers—like Google and Microsoft—and several key customers, to ensure that we remain their trusted advisor on their digital transformation journeys'.

Sales, partnerships …

Accenture, P97 Networks, Aker Solutions, Nvidia, Ansys, Kongsberg Maritime, Bureau Veritas, Bourbon, eDrilling, ExxonMobil, Microsoft, Fat Finger, Geologix, IBM Services, KBR, BHGE, Maana, Met Office, Kongsberg Digital, Orchestrade, Pason, Recon Technology, Sabic, HTE, Seeq, Altira, Siemens, SparkCognition, TIBCO, IHS Markit, Transect, DrillingInfo, Wood, Emerson, Sapien Cyber, PSE, ChemTech, INT, TechnipFMC, IFPen, ConocoPhillips.

Accenture has invested in an alliance with **P97 Networks** to develop digital solutions for major and independent oil and gas, automobile and fuels forecourt retail companies.

Chevron has selected **Aker Solutions** for the FEED on its Jansz-Io field offshore Australia.

Nvidia Quadro has moved to the cloud allowing engineers to run **Ansys** Discovery Live on virtual machine images and perform real-time simulations from a web-based device.

Following successful trials, **Kongsberg Maritime**, **Bureau Veritas** and **Bourbon** have jointly launched a new solution for dynamic positioning system performance and redundancy audits.

Equinor has awarded **eDrilling** a one-year contract extension for its WellAhead drilling optimization software.

ExxonMobil and **Microsoft** are to combine their technical and engineering expertise with cloud and data analytics capabilities to help drive growth in the Permian and serve as a model for additional implementation across the US and abroad. The use of Microsoft technologies by ExxonMobil's XTO Energy subsidiary will make its Permian Basin operations 'the largest-ever oil and gas acreage to use cloud technology'.

Tech start-up **Fat Finger** has been chosen by an unnamed oil and gas supermajor to digitize procedures in refineries and the oil field around the globe.

Geologix Ltd. is to provide Blue Eagle Lithium an integrated asset management system for its lithium extraction activities.

Vivo Energy (Shell's licensee in Africa) has selected **IBM Services** for its digital transformation journey based on SAP S/4HANA.

ExxonMobil has selected **KBR** to provide detailed EPC services for the offsites and interconnecting units as part of the crude expansion project at its Beaumont Refinery on the US Gulf Coast.

KBR has been awarded a technical verification and open book estimate engineering, procurement, and construction contract by Pieridae Energy for a two train 10 MMTPA LNG facility at Goldboro, Nova Scotia.

KBR has chosen **BHGE**'s gas turbine technology as a component of its standardized mid-scale LNG design. Both companies will leverage their service portfolios to provide standard, low capex LNG solutions for grassroots and existing LNG assets.

Maana's Knowledge Platform is now integrated with Microsoft Azure, making Azure services and tools available to all Maana customers and application developers.

The **UK Met Office** and **Kongsberg Digital** have partnered to offer meteorological and oceanographic data to customers, independent software developers and other users of the Kognifai ecosystem in the maritime market.

Engie Global Markets has selected **Orchestrade Financial Systems**' solution to manage its front-end deal management system at its financial and commodities business, including physical gas, power and derivatives.

Pason reports some 200 active rigs running its Drilling Intelligence software. Drilling Intelligence bundles Pason's Autodrillers, ABBL directional advisor, the ExxonMobil Drilling Advisory System and Pivot, a pipe oscillation system for improving slide drilling.

Recon Technology has won an additional two bids totalling some RMB 2.3 million to procure and import 'customized instruments' for China Energy's coal and chemical business.

Sabic and **HTE** have announced a five-year extension of their umbrella research agreement to increase efficiency through digitalization and high throughput technologies in petrochemicals catalysis R&D.

Seeq and **Altira** are teaming to bring advanced analytics to operators. Pioneer Natural Resources and Devon Energy presented their use of Seeq applications at the ARC Advisory Group Industry Forum 2019. Seeq has expanded its integration and partnership with Siemens, demonstrating self-service analytics working with Siemens process automation products.

Siemens is to install a state-of-the-art remote diagnostic service for Gail India covering 29 gas turbines operating across the Hazira-Vijaipur-Jagdishpur pipeline and the Vijaipur C2/C3 Plant.

AkerBP has deployed **SparkCognition**'s SparkPredict on its offshore production platforms to enhance AI applications in its 'Cognitive Operation' initiative, a new upstream transformation project.

TIBCO and **IHS Markit** are to provide advanced analytics to the energy industry through TIBCO Spotfire and related technologies.

Transect and **DrillingInfo** are to collaborate to improve environmental due diligence for the energy market. Users will have access to the Drillinginfo platform from DI Plus, GeoData Services or DI Direct Access.

Wood has been awarded an $8 million contract by Adnoc for the pre-FEED of a new state-of-the-art refinery in Ruwais, Abu Dhabi, set to become the 'world's largest refining and petrochemicals complex.'

BHGE has signed a memorandum of understanding with Qatar Petroleum to expand its presence in the country and to support Qatar Petroleum's Tawteen Program.

Emerson and Repsol are teaming on advanced subsurface geophysical technologies for the oil and gas industry including a joint investment in R&D. Repsol is to implement Emerson's E&P software suite across its global exploration program.

Woodside has invested in **Sapien Cyber**, a Western Australian technology company specializing in the protection and security of critical infrastructure.

PSE has teamed with **ChemTech** to couple artificial intelligence with advanced process models in support of 'look-ahead' advisory tools for operators of large petrochemicals plants. PSE's gPROMS will be combined with ChemTech's OptimEase AI and data analytics system. ChemTech's primary company goal is 'to replace human operators of chemical plants with AI-based systems'.

INT and Total have signed a five-year partnership agreement for a data visualization and analysis platform and software libraries.

TechnipFMC and **IFPen** have extended their partnership for innovation and technological developments.

ConocoPhillips is to contribute a $3 million grant for data science college coursework to **Oklahoma State, Houston and Texas Universities**.

Done deals

Acquisitions and mergers involving 4Subsea, Astori AS, Hexagon, Thermopylae, Bitcoin Oil, Eagle Automation, Cartasite, Equinor, SeekOps, First Reserve, Weir Flow Control, Inventys, BDC Cleantech, Proserv, C-Automation, Quorum Software, Coastal Flow Measurement, Aramco, Earth Science Analytics, Thoma Bravo, Aucerna.

4Subsea has acquired **Astori AS**, a Norwegian provider of subsea control systems for well intervention operations. The automation and control technology ties into 4Subsea's portfolio of critical decision support solutions for operators.

Hexagon has acquired [Thermopylae Sciences and Technology](#). Thermopylae leverages the Google technology stack in its geospatial applications, mobile frameworks and cloud computing for enhanced location intelligence. The technology will extend Hexagon's Smart M.App and Luciad portfolios.

Bitcoin Oil Inc. has reorganized as a wholly-owned subsidiary of an eponymous holding company located in Zug, Switzerland. The reorganization is said to provide Bitcoin Oil with a 'meaningful presence' in Switzerland's [Crypto Valley](#), a 'leading crypto and blockchain hub'.

Eagle Automation has acquired the FieldFlow software from **Cartasite**. FieldFlow connects oil and gas producers with water hauling companies, providing a digital custody record of water volumes hauled, along with time stamps, geo-location, and confirmation of delivery to a water recycling or disposal facility. The software will be marketed from a new unit [Eagle Field Tech](#).

Equinor has made an equity investment in [**SeekOps**](#) of Pasadena, CA, a manufacturer of gas detection devices.

Private equity company **First Reserve** is to acquire [**Weir Flow Control**](#) from its parent Weir Group in a £275 million deal.

Inventys has closed a $5 million investment from **BDC Cleantech Practice** in a Series C fundraising. The CO_2 capture technology company has now secured $16 million under the planned round, which was led by **OGCI Climate Investments**. Funds will be used to complete the Company's 30-tonne-per-day CO_2 capture demonstration plant project with Husky Energy, currently in the final construction stages and due to begin operations in Q2-2019.

Proserv has sold its drilling services business, formerly known as TIC, to [**C-Automation**](#), a global, full-service provider of API 16D BOP control systems and field service offerings.

Quorum Software has acquired **Coastal Flow Measurement** along with its Flow-Cal unit. The transactions will enhance Quorum's software and services in hydrocarbon measurement data management.

Saudi Aramco Energy Ventures has invested in a series A fund raising by **Earth Science Analytics AS**, a Norwegian provider of artificial intelligence software. ESA is developing EarthNET, a cloud-based 'next generation' petroleum geoscience software platform based on artificial intelligence.

Private equity firm **Thoma Bravo** is to acquire **Aucerna** (previously 3esi-Enersight), a provider of integrated planning, execution and reserves management software. Thoma Bravo's $30 billion fund focuses on the software and technology-enabled services sectors.

Natural language processing news

Equinor adds natural language processing to operational planning tool. Max Plank Institute open sources its Ambiverse natural language understanding software. Australian National Data Service releases Swagger OpenAPI-based vocabulary services. Open University and Springer Nature release Computer Science Ontology.

A posting on the **Equinor** (ex-Statoil) website describes how the company has added a natural language processing component (NLP) to OPT, its operational planning tool. NLP is used to locate hard to find information in text data such as incident reports. Context has been built into the NLP tool by training from dedicated, skilled users from Oseberg South to do digital highlighting. Localizing the NLP component to Norwegian meant building it practically 'from the ground up'. The NLP component includes a knowledge graph of information in work orders or incident reports from several plants. Hyperlinks allows the users to open DNV GL Synergi cases directly from the tool. The NLP is work in progress and currently returns many 'less than relevant' results. But its developers believe it will mature to become a 'great asset' in the future. OPT runs in Equinor's Azure cloud. Tessela and Norwegian Bouvet contributed to the Equinor NLP development.

The **Max Plank Institute** has released the Ambiverse Natural Language Understanding suite as open source software. AmbiverseNLU includes named entity recognition, entity and concept linking and knowledge graph components for several languages. A demo is available.

The **Australian National Data Service**, a partnership between Monash University, the Australian National University and the Commonwealth Scientific and Industrial Research Organisation has released a new vocabulary services API. The API enables programmable access to a number of controlled vocabularies for research. The API is built using the Swagger OpenAPI toolset for producing and consuming structured data.

The **Knowledge Media Institute**, a joint venture of The Open University and Springer Nature, has released the Computer Science Ontology (CSO), a 'large-scale, automatically generated' ontology of research areas in the field of computer science. The current version incorporates 14 thousand topics derived from a dataset of some 16 million articles. The CSO extends the BIBO ontology and is released under a Creative Commons license.

Going, going, green…

Gaffney Cline on carbon pricing. IOGP on future climate risk. IEA – world well off-track for climate goals. US DoE funds 'transformational' sensing for CCS. Aker Solutions gets Northern Lights CCS contract from Equinor. UK push for 'Acorn' CCS project. DNV GL publishes world energy systems forecast out to 2050. New methane detection systems from FLIR, eLichens and BHGE. BP teams with EDF on emissions

reduction. Total funds Collège de France R&D into CO2 use. Carbon Engineering gets funding from Oxy and Chevron. Leonardo DiCaprio shows 'how we can solve the global climate crisis'. Texas, Railroad Commissioner defends US' environment stance. InfluenceMap finds majors spent $1 billion 'battling Paris climate deal'. News from the 'International Scalar Wave Quantum Institute'.

Carbon and CO2

A recent **Gaffney Cline** Focus report, Carbon Management, the adoption of carbon pricing in oil and gas, has it that carbon pricing mechanisms (cap and trade, or taxes) are considered by many economists as being the most effective and efficient solution to combat climate change. But these need to be implemented with care. A $100/tonne CO2 carbon price would put a $1 on a gallon of gasoline and would double the price of natural gas. Carbon mitigation solutions that offer affordable and secure oil and gas include energy efficiency, fugitives and flaring reduction, waste heat recovery, use of low carbon energy for power and heat, and ultimately carbon capture and storage.

According to the **International Energy Agency**, progress on CCUS is well off-track when measured against globally agreed climate and energy goals. Today's CO2 capture rate represents less than 4% of that required by 2030 under a pathway consistent with the Paris Agreement objectives.

A 500 page study from the US **National Academies Press**, Negative Emissions Technologies and Reliable Sequestration, a research agenda, includes a chapter on the sequestration of CO2 in deep geological formations, CCS is required/expected to contribute about 14% of the emissions reductions needed to stabilize the climate at 2°C warming. So far results from trials have been patchy, the largest, the Australian Gorgon Project has not yet started. At In Salah (Algeria) and Snohvit (Norway), injectivity has been problematic. Scaling up global CCS to the hoped-for 5-10 Gt/year is 'an enormous task' that would require a more than 100-fold scale-up from current operations at which point CCS 'would assume the scale of global oil production, is a $2 trillion/year industry'.

The US DOE's **Office of Fossil Energy** has announced funding for R&D into 'transformational' sensing capabilities for monitoring CCS. DE-FOA-0001998 sets out to reduce uncertainty and enable real-time decision making associated with subsurface CO2 storage. Selected projects will be managed by the National Energy Technology Laboratory.

Aker Solutions has been awarded a contract on Northern Lights, a CCS project initiated by Equinor with partners Shell and Total. The aim is to develop the world's first storage facility capable of receiving CO2 from various industrial sources.

Chris Stark, chief executive of the **UK Committee on Climate Change** has urged the UK to move on from "false dawns" for carbon capture and storage (CCS) and pursue strategic projects, such as Acorn, to help address climate change.

DNV GL has published its Energy Transition Outlook, a model-based forecast of the world's energy system through to 2050, covering energy demand, oil demand, electricity capacity and carbon emissions. Forecast data can be downloaded here.

Methane emissions

FLIR has announced the FLIR GF77, a 'lower cost' gas methane detection camera. The FLIR GF77 'gas find' camera is built around an uncooled, longwave infrared detector, which costs less to produce than higher performance, cooled cameras.

eLichens has launched the Foxberry-CH4 methane sensor for gas leak detection. eLichens uses a patented non-dispersive infrared wide bandwidth light source in an ATEX certified explosion-proof housing.

BHGE has announced Lumen, a ground and/or drone-based methane detection system. Lumen provides continuous wireless methane detection and real-time cloud-based data analysis. Lumen comprises a ground-based solar-powered wireless sensor network and a drone-based system for over-air monitoring. The Lumen Terrain ground-based system creates a mesh network around a facility, outdoors and indoors. Lumen Sky adds a multi-faceted UAV system using a state of the art TDLAS and OGI technologies, along with high-definition aerial video streaming. Proprietary algorithms and machine learning provides methane concentrations and location and rate of leaks.

BP and the **Environmental Defense Fund** have announced a three-year strategic commitment to advance technologies and practices to reduce methane emissions from the global oil and gas supply chain. EDF will not receive any funding from BP, consistent with its policy prohibiting receipt of funds from energy companies. Rather, BP and EDF are working to identify third-party analytical and technological demonstration projects. These include methane monitoring and management and the use of 'digital technologies', as enumerated in the EDF's report, Fueling the Digital Methane Future, produced with help from Accenture. Machine learning, artificial intelligence and augmented reality will embed methane management into BP's digital transformation. BP also announced that greenhouse gas emissions reductions have now been included as a factor in the reward of its 36,000 employees.

CO2 use

Total has signed an R&D collaboration agreement with **Collège de France** for research into the transformation of CO_2 into hydrocarbons and alcohols. These technologies are presented as potential energy storage solutions using electricity from renewables to turn CO_2 into ethylene or ethanol.

Carbon Engineering has received equity investments from Oxy Low Carbon Ventures and Chevron Technology Ventures. The monies will be used to accelerate the commercialization of CE's direct air capture technology that removes CO_2 from the air. CE's DAC plants can be located at an oilfield for EOR use. The company is also working on 'air to fuels' technologies, combining CO_2 from DAC with clean hydrogen from water electrolysis.

One Dato' Sri Prof. Ng Tat-yung, founder of the '**International Scalar Wave Quantum Institute**' has announced an innovative solution for hydrogen production by electrolysis of atmospheric water. The zero-pollution hydrogen fuel is claimed to be a 'sustainable green energy solution'. The 'scalar wave quantum implanting technology' involves 'Zeus super metals' with a 'quantum state of wave-particle duality', which offer a 'surge in performance' in catalytic converters used in hydrogen fuel cell vehicles.

Comment: Getting hydrogen fuel from water or producing hydrocarbons or ethanol from CO2 requires energy input. The 'greenness' of such technologies depends on the availability of electricity from renewables. They are in no way energy sources. At best they could be considered as (probably very inefficient) energy storage systems.

Climate

The **IOGP** has been looking into the [future climate risk](#) for the oil and gas industry. Oil and gas facilities are at direct physical risk from flooding, exposure of personnel to an increased risk of heat stress and increases in extreme waves. The IOGP's Metocean Committee is currently reviewing the workshop material to identify risk that can be further understood through working groups and future joint industry projects.

A 'state-of-the-art' [climate model](#), funded by the **Leonardo DiCaprio Foundation** is claimed to 'show how we can solve the global climate crisis'. The model, from the University of Technology Sydney, claims to show a 'one generation' decarbonization pathway that does not involve CCS or geoengineering. The research was funded by the DiCaprio Foundation's new One Earth initiative.

In response to a 'coalition of climate catastrophists', led by Environment Texas, **Railroad Commissioner** Wayne Christian defended the US' stance on energy and the environment. 'In 2018 the US lowered its carbon emissions more than any country in the world. These reductions result from our increased production and use of natural gas, not from punitive government policies such as carbon-taxes or emission reduction mandates.'

InfluenceMap author Edward Collins has analyzed corporate spending on lobbying and advertising and found that oil majors have spent $1 billion battling the Paris climate deal since 2015. Chevron, BP and ExxonMobil were the firms spending the most on lobbying to push against reforms to tackle global warming, using social media to push their agenda to oppose meaningful legislation, the report claimed. Shell 'firmly rejected' the report's findings.

Energy Conference Networks' 2018 Supply Chain Conference, Houston

DataGumbo: Blockchain to replace siloed ERP systems. MDxBlocks' end-to-end blockchain solution. Weatherford: Compliance in a world sanctions. Hess 360 supply chain management. US Oil & Gas Blockchain Forum. Engage Mobilize's digital transaction API. GEP Smart, cloud-native, source-to-pay software.

Andrew Bruce (**[DataGumbo](#)**) contrasted the siloed ERPs of the 'traditional economy' with the new world of the 'commercial internet'. Here participants share immutable records and enact frictionless transactions, all enabled by … blockchain. 'Just as web browsers turned TCP/IP into the internet, blockchain creates the commercial internet, connecting companies with smart contracts'.

Badruddin Pitter (**MDxBlocks**) describes blockchain as an opportunity to share information about vendor, customer and product in order to achieve transparency, traceability and identity across the supply chain. MDxBlocks' [TotalRecall](#) is an end-to-end blockchain solution that currently tracks perishable goods from producer to retailer.

Weatherford's Melissa Bohannon showed how compliance can be enhanced through supply chain digitization. Trade compliance needs logistics, procurement and sourcing data to support duty saving programs. Free trade agreements are an opportunity to reduce costs by avoiding duties, but they are extremely difficult to manage because of the lack of consistent information and processes throughout the supply chain. Often data must be manually keyed-in by freight forwarders and customs brokers because basic electronic data sharing has been overlooked. 'We cannot reach a true digitalized state without eliminating manual data entry'. Weatherford has over a million items in its ERP inventory. Recently, companies have suffered from punitive tariffs on imported steel, aluminum and Chinese goods. Such changes can disrupt businesses. Unfortunately, current ERP systems were not designed to manage trade compliance and are not flexible or nimble to adapt to the changing environment. The world of sanctions has shifted from multi-lateral agreements to those that are issued by individual governments targeting a particular industry, or even individuals. International operators need to be able to block transactions with named parties and entities in which they have majority ownership or control. Sometimes the same transaction can be legal if it originates from a different country! Such considerations are hard to managed in ERP systems. Digitalization has to include not only ERPs inventory, asset management, procurement, sourcing and manufacturing needs but trade compliance needs as well.

Nigel Bell provided an overview of **Hess**' '360' supply chain management system. Hess currently has some 4,000 suppliers. This needs to change. Hess is to consolidate with fewer suppliers, deeper relationships with integrated/democratized data and 'longer, stronger' contracts. Today, suppliers operate with varying levels of data integration with Hess and collaboration across the supply chain is hampered with data siloes and many disparate systems. Hess 360 sets out to change this and bring visibility and collaboration to the value chain, generating insight into supplier performance gaps, suggesting countermeasures and pinpointing areas of inefficiency and waste. Hess 360 components include SAP, WellView, Synergi, QEMS (Quality Data), ISN (Safety Assurance Data), Ariba (Contract Info) and an in-house Opportunity Register for innovation. Hess 360 has enabled provides the workforce with agile, modern tools. An ecosystem of partners has enabled collaboration and integration beyond the enterprise firewall.

Raquel Clement (**Chevron**) introduced the Energy Conference Networks-hosted US Oil & Gas Blockchain Forum that kicked off in February 2018. Blockchain 'has the potential to transform how we work' with a more seamless way of working and a central source of truth where business activities can be self-executed and recorded in real time. A more formal US Oil & Gas Blockchain Consortium was founded in January 2019. More from the Forum.

Robert Ratchinsky (**Engage Mobilize**) claimed that a mid-sized independent E&P can do up to a million transactions on paper per year with hundreds of service providers. 'Billions are spent in the dark'. Today, incredibly, 'most transactions are completed using a simple carbon copy hand written approach'. The subsequent task of data input costs companies billions industry-wide. Enter Engage Mobilize's 'next gen' digital transaction platform. This tracks multiple oil country services types and leverages geofencing technology to enhance security and transparency. The Engage API allows for integration with databases and ERP systems. Engage works off the cellular service and is used in five US States by 'two of the top 10 domestic producers'. Today, 106 service types are being tracked and ticketed on the platform.

Tim Clem presented a similar digital supply chain solution from **GEP**. SMART by GEP claims to be the 'world's first' cloud-native, source-to-pay software that delivers comprehensive spend, sourcing and procurement functionality in a single, unified platform for direct and

indirect spend management, from sourcing to payments and from spend analysis to savings tracking.

Blockchain news

US NIST secures 'smart' manufacturing systems with tamper-proof system, releases UML code for implementation. US Offshore Operators Committee kicks-off US Blockchain Consortium. News from SAP's Enterprise blockchain summit, Berlin. Kraken IM's blockchain for engineering. ZiyenCoin, a 'regulated' oil cryptocurrency. But are these really blockchains?

Engineers at the **National Institute of Standards and Technology** (NIST) have used blockchain to secure 'smart' manufacturing systems. The system provides tamper-proof transmission of manufacturing data and traceability to all participants. Blockchain is a component of NIST's 'digital thread', an engineering information management system that is to replace two-dimensional engineering blueprints. The solution is designed to counter 'bad actors' that tamper with data files. The NIST report includes UML codes for implementing a blockchain in a smart manufacturing network. Partners in the NIST blockchain community of interest include IBM, Lockheed Martin, MIT and Penn State University. Read the Security, Traceability for Smart Manufacturing paper here.

The Offshore Operators Committee (OOC) has kicked-off the **US Blockchain Consortium**. The new organization is to establish blockchain standards, frameworks and capabilities for the oil and gas industry. The OOC will be conducting proofs of concept with the emerging technology in 2019. OOC chair Rebecca Hofmann, said, 'Blockchain is a catalyst for reimagining the way we do business and this consortium represents a collaborative effort to explore the technology's potential and leverage learnings to drive industry adoption'. OOC BCF members include Chevron, ConocoPhillips, Equinor, ExxonMobil, Hess, Pioneer Natural Resources and Repsol.

SAP recently hosted an 'Outside the Block' enterprise blockchain summit in Berlin to present use cases and discuss what the future has in store for blockchain. SAP's Martin Heinig said, 'The days are gone in which the Cold War was a fitting metaphor for the way companies shielded their knowledge and businesses. At SAP we believe that this openness that allows ourselves, our customers, and partners to tap into the wisdom of the larger SAP ecosystem'. Partners in the SAP event included Telekom, Dell EMC, Camelot IT Labs and Wipro. Use cases mooted at the SAP event include quality assurance in pharmaceuticals from Modum and in food supply with a farm-to-consumer blockchain initiative. IBM presented the benefits of blockchain in the oil and gas industry.

Kraken IM has developed a blockchain for the engineering supply chain. Kraken uses the blockchain to permanently record changes to engineering data and documents, when they are shared or added to by vendors and contractors and time-stamping data so it cannot be tampered with. Automated, blockchain-backed transmittals can be used to prove who sent what and when. The Kraken blockchain was developed as a proof of concept for the Cfihos project (see elsewhere in this issue).

Ziyen, which describes itself as a "Scottish-American" company developing procurement software (and which is also a US oil producer) has further diversified with a 'new and innovative' division, ZiyenCoin. The new unit is to launch 'ZiyenCoin' , the first oil and gas security token offering. ZiyenCoin will 'push down the price of oil production' by removing volatilities and finance changes. ZiyenCoin will be 'the first regulated oil and energy benchmarked cryptocurrency'. *Caveat emptor!*

Comment: We have invited a few blockchain advocates for comment on our scurrilous editorial 'blockchain is bullshit'. Some have ignored us. Others grudgingly acknowledge that the technology controls a digital token that cannot 'guarantee' a transaction of physical goods. Another fact to emerge from our ongoing investigation into 'blockchain' is that it is not always (ever?) really blockchain. Instead of the energy hungry technology that drives bitcoin, 'blockchain' projects may be using some form of generic DLT, distributed ledger technology. DLT and blockchain are not the same as elegantly explained on Hardfork where we read, 'The terms DLT and blockchain are not interchangeable, even if they may be used as such. Organizations like the Bank of England might favor the use of DLT to distance themselves from the hype and volatility associated to blockchain. Or for the same reason, a corporation may use the word blockchain to capitalize on the interest, even if what they are offering isn't truly, a blockchain'.

Wireless world

Communications announcements from Anybus, Blackline Safety, Tampnet, Iridium, LightPointe, Fairfield Geotechnologies, Siemens, Sierra Wireless, Speedcast.

Anybus' Wireless Bolt is an all-in-one package featuring, connector, communication processor and integrated antenna that provides external Bluetooth or WiFi access to an industrial device. The device attaches to a machine or cabinet and provides BYOD connectivity over a 100m range.

Blackline Safety's G7c is a combined personal gas detector and two-way radio with a 'push-to-talk' function. The new device complements Blackline's cloud-hosted user portal, an online regulatory compliance dashboard and analytics software.

Speaking at the 2018 OilComm/FleetComm conference, Anders Tysdal discussed **Tampnet**'s expansion from its North Sea roots to the Gulf of Mexico. Tampnet will soon have 60+ base stations operational, covering nearly 96,526 square miles and 98% of all manned offshore assets in the GoM with a 4G LTE service. The North Sea Tampnet was recently enhanced with a dedicated high-speed, low-latency 4G system from **Marlink**.

Iridium Communications has launched its Iridium Certus broadband service, the first new capability activated from the company's $3 billion Iridium NEXT satellite replacement program. Certus is a global broadband service offering on-the-move internet and high-quality voice access. In a separate announcement, Icom is to add its push-to-talk handheld radio to the Iridium network.

LightPointe has announced the AireLink 60 10 Gig, a high capacity, full-duplex 60 GHz backhaul radio with a low latency, full-duplex 10 Gbps bandwidth.

Fairfield Geotechnologies has selected **Marlink** to provide a customized VSAT solution for two ocean bottom node seismic survey vessels operating on behalf of its oil and gas industry clients. Marlink also provides an onboard wireless internet service via the Marlink's Xchange. Xchange was also deployed recently on Transpetrol's tanker fleet. Announced last year, Marlink's XChange Cloud is a secure and scalable platform for the transfer and synchronization of files between ship and shore. Application scenarios include storing and sharing status reports from on board engine monitoring systems for input to operator's ERP and maintenance management systems.

Siemens has announced a novel form of data transmission that uses power cables to transmit data along with current. The powerline technology is a functionality of Siemens Sivacon 8PS 'busbar' trunking system.

Sierra Wireless' AirLink RV55 LTE-A Pro cellular router connects critical remote assets, infrastructure and mobile workforces. The cellular IoT solutions is a compact, rugged router for scada, distribution management systems and service vehicle fleets.

Speedcast is installing a 'multi-million dollar' telecom system for Noble Energy's Leviathan Eastern Mediterranean gas platform. The solution integrates multiple onboard communications and security systems. Scope of work spans telecommunications cabinets, company LAN, Wi-Fi, VoIP, CCTV, structured cabling, radio systems, 4G/LTE, IPTV, weather observation system and emergency satellite phones.

A wake up call for BYOD

OilComm/FleetComm presentation from RML Business Consulting warns of 'surveillance capitalism' and the considerable dangers of a 'bring your own device' policy. Terms and conditions of mobile device hardware and services (including cloud computing) merit scrutiny.

Speaking at the 2018 OilComm FleetComm conference in Houston last year, Rex Lee, from RML Business Consulting provided a wakeup call to all whose employers operate a 'bring your own device' policy. Lee categorizes the current practice of providing free mobile services as 'monetizing the user', aka 'surveillance capitalism'. Lee asked if attendees believed that they could secure their smartphone or tablet PC with preinstalled or third party apps, or if they would 'knowingly allow 15 or more multinational companies to monitor, track and data mine your home and office phone activity including content?' This is pretty much what all smart devices do all the time. 'Connected products are intentionally designed to enable content developers monitor, track and data mine the user for financial gain at the expense of the product user's civil liberties, privacy, cyber security and safety'.

In other words, the Android and Apple operating systems are definitely not private, secure or safe forms of telecommunications and computing! Android devices and iPhones allow multiple third parties to collect and use personal information. The surveillance capitalists use multiple ways of harvesting personal digital DNA, with obscure legalese in their terms of use that may violate consumer laws. Moreover, hundreds of apps widgets and other content may be preinstalled on a device and the collective terms of use can exceed 3,000 pages of 'misleading and contradicting' legalese.

The GAFA's are engaged on a new gold rush for your digital DNA which is being leaked to your service providers and their business partners including companies from China. Lee warns, no product is private, secure or safe. Stay away! Corporations need to verify terms of use of all devices and services (including cloud storage) to demand transparency from service providers. Vendor communications regarding official business should not be done on consumer grade technology. But most important of all, do not allow 'bring your own device' and terminate any such program forthwith. Next talk with your telecom provider and discuss privacy and cyber security issues associated with connected technology. Demand transparency, ask questions, file complaints, and litigate if necessary! At a personal level, individuals need to prod their elected and government officials to take action!

Lee, who manages the www.MySmartPrivacy.com portal, speaks from 35 years of wireless industry and application development experience and as a contributor to the 2017 Department of Homeland Security [study on mobile device security](#).

Postscript: Right on cue we now have the [WhatsApp breach](#)!

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