TACKLING THE BIG DATA BOTTLENECK

A USD17.5 million joint industry-academia project is speeding up information retrieval from complex databases

Oil and gas companies face a long-standing industry problem in accessing data. It is one of the challenges of larger, deeper and more remote operations, but now comes with the added complexity of collecting and interpreting a huge surge of real-time, digital information generated by multiple fields and plants.

Over recent years, a range of advanced tools have come to the market to help operators make sense of this so-called 'Big Data', in order to understand how to bolster performance across thousands of wells and, in real-time, monitor the condition of advanced equipment. But the technical limitations of today's computing systems are already struggling to manage the amount of information that some operators are required to handle, sparking a search for smarter ways in which data could, and should, be analysed. Big Data solutions aim to effectively aid decision – making, allowing users to work more effectively by focusing on accurate information and how to use it when required.

Big Data is often characterised and quantified by reference to 'the three Vs' – volume, velocity, and variety – a description originally coined by Doug Laney, now research vice president of technology analysts Gartner Research.[1]

In explorative drilling, for instance, a company will evaluate an area, drill a well, gather real-time data and input this into its system to inform planning for the next well before drilling it. Companies may re-evaluate fields every week and in many places, driving the volume of data ever upwards.

> "Our ambition is to allow engineers to independently navigate, retrieve and simplify complicated data, and reduce the time it takes to access what they need ... to just a matter of minutes"

Professor Arild Waaler, coordinator, Optique JIP

A collaborative response

As companies seek smarter ways to handle the influx of complex data, joint industry projects (JIPs) have begun to explore ways of saving time, money and energy through shared goals.

One such initiative is Optique, a four-year joint industry project between several world-leading academic institutions and industry partners. It exploits recent advances in semantic technologies, in which the meaning of data is explicitly represented as part of the data model. The aim is to develop a software platform to provide end-users with flexible, comprehensive, and timely access to large and complex industrial data sets – in processing petabytes of well data, for example – by making computers use the language users understand and are used to.

University of Oslo (UiO) professor Arild Waaler, who coordinates Optique, initiated the project in 2010 and has received backing from Norwegian oil company Statoil, DNV GL, German engineering group Siemens, and fluid Operations, a German provider of innovative cloud and data management solutions. The EUR13.8 million (USD17.5 m) programme launched in December 2012 with EUR9.7m European Union funding.

The Optique team expects its approach to reduce turnaround time for >

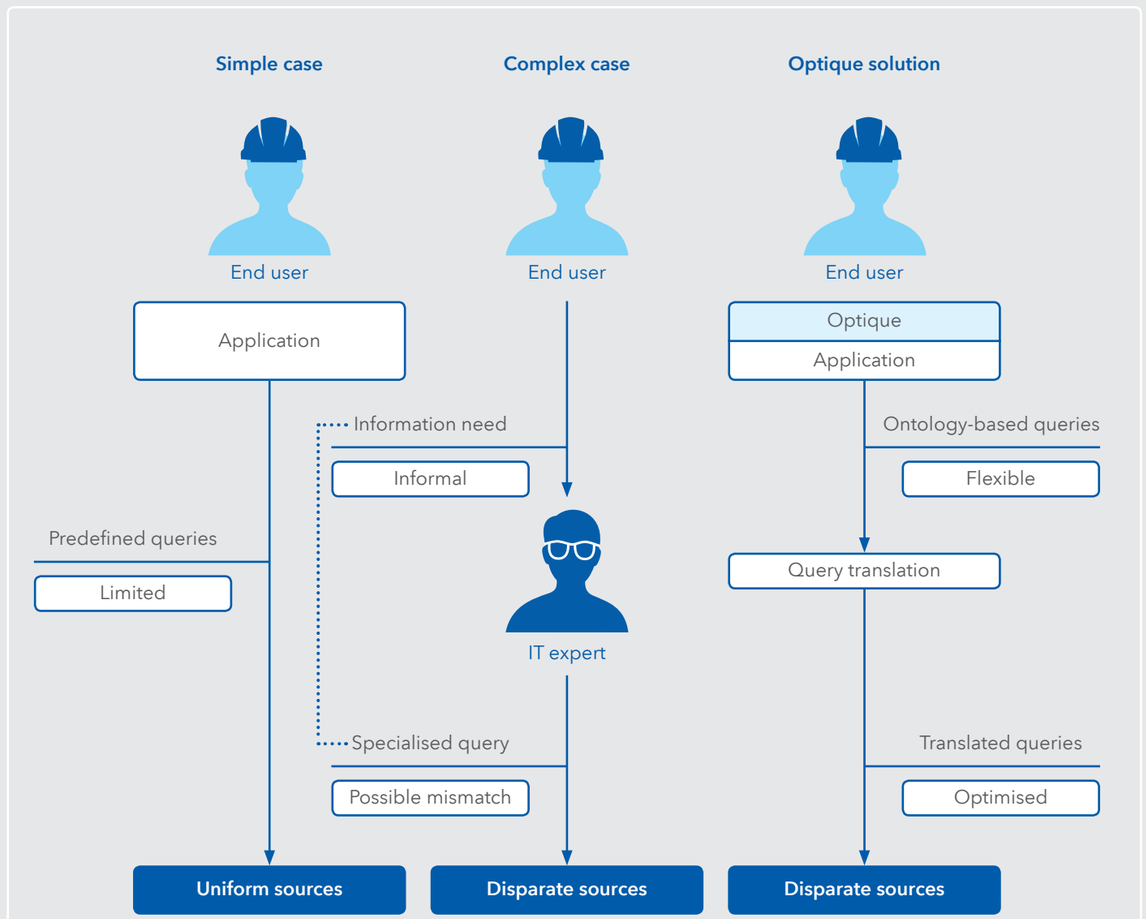


Figure 1: Common data access scenarios in enterprise context and the Optique approach

Simple case

Most users cannot write questions (queries) in special ways (structured languages) to access relevant data quickly and in required formats. A 'simple data access' model offers a limited range of set questions and information types to pull data from various databases that are equally easy or hard (uniform) to connect to and control.

Complex case

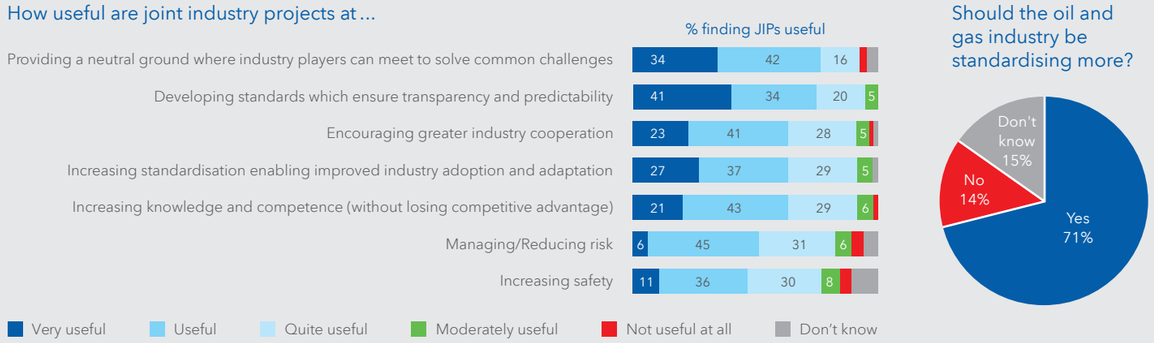
The complex case is a 'man-in-the-middle' approach where users send information needs to IT experts who in turn write more sophisticated queries. This finds the right information and presents it in ways that are useful for the purposes involved, but limited IT staff numbers mean it can take days to weeks for users to get it back.

Optique solution

The Optique JIP exploits advances in semantic technologies that can explore meaning and context behind words and sentences. The goal is software that allows people to use computer language that they can understand so they can get flexible, comprehensive, and timely access to large, complex industrial data sets.

Source: Optique JIP

Joint industry projects: What do participants get out of them?



Source: 65 responses to TNS Gallup AS survey (2014) of 67 participants in DNV GL-led JIPs

information requests from days to minutes, while also advancing to data sets whose size and complexity is beyond the reach of existing technologies.

The big picture

Waaler believes that the majority of current solutions for Big Data focus solely on volume and processing large amounts quickly. The Optique project adds another dimension to the three Vs: complexity.

"Traditional technologies are extremely good at volume, but compromise a lot on variety, velocity and complexity," he said. "Optique is unique in focusing on all these dimensions simultaneously. It also addresses trustworthiness by showing where data came from and how it has changed, providing transparency for the end user."

Take the variety aspect for instance: "Statoil has hundreds of terabytes of stratigraphy and seismic interpretation data that needs analysis in large and very complex databases. You cannot do this with only the methods developed for big volumes of data, but it is a main goal for Optique. We focus on variety, velocity and complexity, then consume as much data as we can without compromising too much of the other dimensions."

Optique aims to test and implement a long-term solution for data access that creates a tool for end users to find data on their own, which they cannot do now.

Waaler explained: "Geologists and engineers know what they need, but the problem is posting a complex query to multiple databases. This is impossible without sending a request to IT experts, a scarce resource. End users must wait for these experts to create complex queries. This may take up to several weeks and considerably delays decision-making."

Optique plans to provide tools to allow a user to query data without assistance from IT experts, and get the result in minutes, he said. "This will open up new exploratory and interactive ways of working as users get more relevant data sets in shorter time. We see Optique as the central tool for exploring information and returning timely, complete, and accurate results. Users can then focus fully on what they are trained in."

A challenge to industry

The Optique solution has been tried and tested in the laboratory. The next step is to implement it within the industry, and DNV GL has taken on the role of bridge builder between the theoretical and practical worlds. Waaler said remaining challenges include speeding up the performance of the back end by applying massively parallelised solutions and also tools to ease establishing and maintaining installations of the Optique platform.

In early 2015, the Optique team plans to present current results at a conference in Høvik, Norway. The aim is to recruit interested companies as partners to the project. The vision is that by 2020, Optique methods and technology will be incorporated into mainstream information management products delivered by trusted vendors.

"We will deliver a good concept, but this will not be something that can be delivered to the industry two years from now. I hope that by then we have something so impressive that the industry will want to continue to fund this project. I am optimistic," Waaler said. ■

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1 Laney, D: '3D Data Management: Controlling data volume, velocity, and variety'; Meta Group (now Gartner) (2001)

ARCTIC 'RIGSPRAY' SIMULATION

Sea spray icing is one of the major challenges for drilling rigs, production platforms and vessels in Arctic conditions, yet understanding of how it is generated is limited to very local metocean conditions and sporadic vessel designs.

This needs addressing as Arctic oil and gas activity grows. Operational capabilities of conventional vessels and offshore structures do not currently meet requirements for Arctic conditions.

DNV GL is initiating a 'RigSpray' joint industry project (JIP) to develop a simulation model bridging functional winterisation requirements and real physical conditions for drilling rigs, production platforms and vessels.

It aims to guide the implementation of icing-mitigation measures to deliver safety and cost benefits. Experts from the maritime and oil and gas industries are invited to join.

The first step is to develop software to further understand sea spray icing using mathematical modelling and measurements. This will provide a solid basis for extending local ice estimations to a wider spectrum of metocean and structural conditions.

This in turn will lead to safer and more cost-effective winterisation solutions for drilling rigs, production platforms and vessels operating in cold climate areas where sea spray icing is likely.

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BLOWOUT PREVENTER MAINTENANCE

Traditional time-based maintenance of blowout preventers (BOPs) has significant financial, logistical and safety implications for drillers and rig owners.

Current regulations in some jurisdictions propose alternatives to time-based maintenance. One example is the Petroleum Safety Authority of Norway which has focused on drilling operators' maintenance functions, thereby increasing industry understanding of risk-based maintenance. The US Bureau of Safety and Environmental Enforcement is also drafting new rules for BOPs, aiming to boost their capabilities and increase assurance that they will work in an emergency.

DNV GL has established a JIP to develop a risk-based method for more effective and cost-efficient maintenance. Time-based maintenance can create critical challenges such as unstructured maintenance management, high operational downtime, reduced reliability and complete equipment overhauls. The benefits of risk-based maintenance include increased safety and optimal maintenance planning to reduce costs. The initiative aims to provide a recommended practice or international standard within which appropriate maintenance requirements and methods will be identified.

Several BOP manufacturers, operators, rig owners and shelf state regulators have joined the JIP. Others are still welcome on board. A kick-off meeting with industry partners took place in Norway in September 2014.

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SMALL-SCALE LNG RELEASES

The oil and gas industry has asked DNV GL to initiate a joint industry project to better understand the consequences of an accidental liquefied natural gas (LNG) release.

In particular, challenges remain regarding development of small scale LNG. Regulators in European countries such as the Netherlands and United Kingdom (UK) are currently working on issuing standards for the safe design, siting, construction and operation of LNG filling stations.

The JIP will contribute to the development of well suited safety standards and guidelines for small-scale LNG bunkering and filling stations. DNV GL has already taken steps towards harmonising LNG bunkering operations by launching a Recommended Practice (RP-0006) providing guidance on how to do this safely and efficiently.

The JIP will run in collaboration with E&P companies and LNG market stakeholders.

Experiments at DNV GL's Spadeadam Test Site in the UK will gather data to study and understand LNG behaviour following a system failure.

The programme will also include demonstration tests needed to quantify certain major hazards.

Information generated from the tests will be used for quantitative risk assessment.

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