Integrating subsurface data with Cognite

For the subsurface and drilling domain, Cognite is developing tools to help find, integrate and work with data, together with Aker BP

The original business model for Cognite was to integrate real time data from oil and gas operations. Its data integration business model is also useful with subsurface and drilling data, which is not real time but still has big search and integration challenges.

Here, the company's main aim is to help domain experts find data, something they often have to spend a lot of time doing, before they get to their main work.

Data is often only accessible through the software used to create it, such as with subsurface models.

And sometimes people have challenges knowing where to find it. "In order to even start your workflows you need to understand what data is stored, which applications [created it], who is responsible for the project," says Dr Carlo Caso, Senior Director of Product Management, Cognite, a former oil and gas exploration geoscientist.

He was speaking at an online conference session during Cognite's "Ignite Talks" industrial digitalisation event.

"We are using the capabilities of Cognite to liberate this data and information from legacy applications and make them available in the cloud to a modern application program."

This includes both seismic and other exploration survey data, and subsurface models.

With data 'liberated' and integrated, it is possible to offer very useful functionality for geoscientists, he said.

For example, they can find what documents a company has related to their area of interest using "polygon search". They search by drawing a box on a digital map to define this area, rather than from looking through folders and databases.

It would also be useful for geoscientists to be immediately informed if there is new information on the company's archives relating to this search area. They would like to know where the data they are working with has come from.

Integrating in the other direction with Cognite's platform, it is possible to connect the subsurface data directly to data science or low code tools, for example running a Python script on it. You can develop new workflows. "There's no friction or barriers between one step and the other," he says.

Aker BP

Kjartan Nesse, Vice President of Digitalization, Aker BP, and head of the subsurface hub (including drilling and wells), said that when the company had internal discussions about what they would most like to see improved, the biggest area of interest was data and data quality.

The biggest challenge is "figuring out what data we have, without spending tons of time on it," he said. So much time is spent looking for data, and some work gets done more than once.

The company had originally planned to focus on blockchain and machine learning. "Suddenly we had to shift," he said.

"We see that when data is available, a lot of creativity from very skilled engineers and G+G people comes to play, in a much better way," he said.

Engineering teams from Cognite are working together with domain experts from Aker BP to try to get there. At the time of the discussion in October 2020, the tool had been released in "early stage" to 100 users.

Improvements had already been seen in the understanding of data quality. It also leads to an increase in the level of interest people are taking in data, including data from domains other than the one they usually work in.

"I think that's all about having ease of access and availability," he said. "It is so interesting when you 'surface' the data - the understanding of what quality of data you have and don't have."

For future technology purchasing decisions, the company will have a preference for open platforms and open standards, such as data formats in the Open Subsurface Data Universe(OSDU), he said.

Aker BP will preferentially buy software with APIs which work well, he said. "We see a lot of applications have APIs but they are not really used because they are not made for having this kind of ecosystem working."

"I'm envisioning an ecosystem where we [connect] different major components," he said. For example it could bring software components from Schlumberger's Delphi cloud environment together with components from a small technology company.

Bluware VDS – a data environment making seismic AI easier

Bluware VDS is a cloud-native data format for storing seismic data, which makes it easier to run AI on it

Bluware, a seismic technology company headquartered in Houston, developed a data storage environment for storing seismic data, which makes it much easier to run AI algorithms when streaming data from the cloud, says Dan Piette, CEO of Bluware.

The format, called VDS (Volume Data Store), is a modern alternative to the SEG-Y seismic data format.

VDS has been developed and improvised since 2003, when Bluware developed a software platform for a major international oil company to use in desktop geoscience applications.

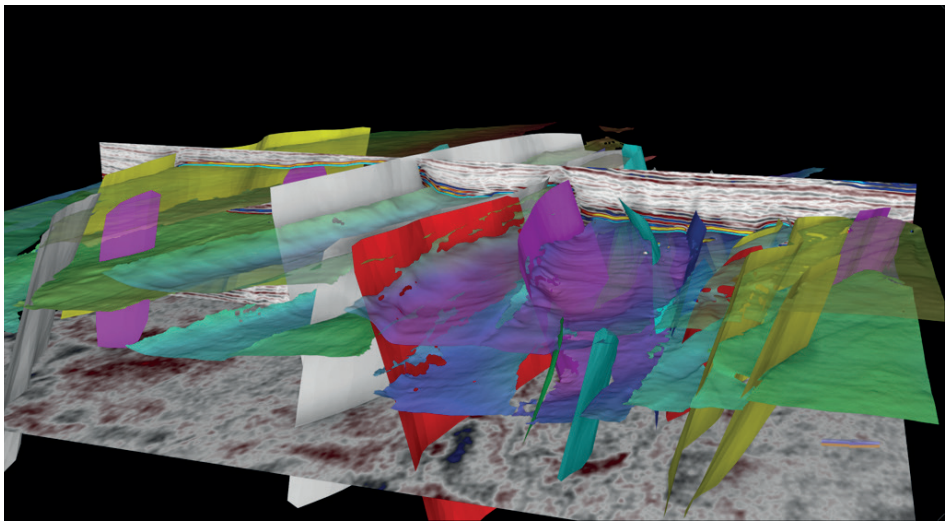
Bluware's founders previously worked in the computer game industry, who had different expectations than other oil and gas software companies about how fast software should run.

Bluware's founders worked hard on developing a technology which could provide rapid access to all seismic data regardless of the size.

Other companies at the time were all using SEG-Y format, a standard originally designed for storing data on tape.

Software using SEG-Y data had to ensure that the file sizes were not so large that they crashed or slowed down the platform. The SEG-Y data resolution was reduced or set to a maximum project size. This was a time when 3D visualization was becoming the

Dan Piette, CEO of Bluware



Fault surfaces from deep learning

norm and applications required access to data in all directions instantly.

Rather than reduce quality or the size of the volume being viewed, Bluware instead, developed its own VDS format to overcome these limitations.

Later, when geoscience software started moving to the cloud around 2018, VDS turned out to be a much better format, as being "object orientated", given that SEG-Y data was much more difficult to use directly with cloud software, Mr. Piette said.

Bluware today

To develop the software further, venture capital has been raised from EV Private Equity, a company that invests in innovative technology companies within the oil and gas industry.

Shell, as Bluware's main client, also wanted involvement, so provided investment through Shell Ventures.

According to Bluware's website, clients include Equinor, Shell, BP, Polarcus, Lundin Petroleum, and Aker BP.

According to a Bluware press release in June 2020, they announced an agreement with BP to provide its technology to help BP improve 'quality and speed when delivering seismic interpretation products.'

BP said it would implement Bluware's InteractivAI deep learning technology, to support geoscientists' ability to interpret subsurface data.

The data storage and software are on Microsoft Azure cloud hosting platform. Bluware has a partnership with both Microsoft and AWS.

How it works

Here is an explanation of how the VDS file format enables Bluware to deliver an interactive experience with their InteractivAI deep learning solution.

Using deep learning to identify geo-bodies in seismic data requires the seismic volume to be output as millions of small image blocks, that are then randomly sequenced before being organized into a 1D 'stack' file for import into a machine learning platform like TensorFlow. This is time consuming and costly.

The data needs to be brought into the deep learning algorithms randomly, not sequentially, because a sequential data flow will mean that the training will only work on the section of data it is receiving at that time, not the whole of it.

The randomisation of seismic data in a SEG-Y file is a challenge, Mr. Piette says. "You can do it, people are doing it, but about 80 per cent of your time is consumed with preparing the data."

As a separate step, you manually extract lines and crosslines from the SEG-Y, which are saved as images and exported into the machine learning platform.

But once data is in VDS format, it can be streamed directly and completely randomly into the machine learning platform. There is no need to copy, crop, or decimate any data thereby eliminating preparation time.

The computer system can be running deep learning algorithms as soon as a geoscientist begins training the network and can immediately infer similar patterns within the seismic data.

Working with AI

The result is the geoscientist is much more productive when using deep learning workflows on seismic data in VDS.

The geoscientist starts by labelling a geologic feature on the seismic data. Since the data is stored in VDS format, InteractivAI can pass the native data and labels directly into a deep neural network to begin training.

The trained network can then stream a live inference on top of the VDS seismic volume instantaneously allowing the geoscientist to work interactively with the network.

As the interpreter adds more examples, the network becomes more accurate in delivering live inferences. Once the accuracy is sufficient to meet the interpreters needs, the trained network can be used to create an entire feature volume identifying all occurrences of the feature in 3D. The workflow is the same for any number of geologic features, be it faults, salt, channels, incised valleys, or even igneous intrusions.

By blending the expertise of a seasoned interpreter with the rapid pattern recognition of a neural network, you can deliver 'human-like' interpretations across entire datasets in hours, instead of weeks.

Geoscientists will begin to see the inferences from deep learning appear on the screen in real-time as they work, "something that no-one has been able to do until now," says Mr. Piette.

The geoscientist can then decide whether or not the computer's assessment is correct or if more training is required. This is all done interactively in minutes.

"It is like an empirical [experience based] analytics of what's going on in the subsurface," Mr. Piette says.

"You end up with a processing of seismic data that is orders of magnitude faster," he said. "One client told us - their interpretation went from a three-month cycle to a three-day cycle."

Geoscientists can also work proficiently.

Ultimately it means that geoscientists are spending more time on core concepts of trying to make geological sense of what they see, rather than "picking wiggles". It is allowing them to work more efficiently, rather than replacing them, he says.

Open Source

In June 2020, Bluware contributed OpenVDS Version 1.0 to The Open Group Open Subsurface Data Universe (OSDU) Forum.

The Open Group OSDU Forum aims to develop a standard structure for storing subsurface data, including seismic data and well data. The OSDU consists of more than 195 companies including oil companies, infrastructure providers, and independent software vendors.

Bluware now also provides OpenVDS+, a free-to-use library that adds Bluware's industry-leading wavelet compression technology to OpenVDS.

Integration

The Bluware platform has APIs, enabling

seismic data in VDS format to be accessible to other geoscience tools and machine learning algorithms.

If you want to get the benefits from VDS without changing your existing interpretation applications, you can use its data streaming and transcoding tool namely Bluware FAST. Data in VDS format is streamed from the cloud, transcoded, and presented as a virtual file in any seismic format including SEG-Y, SEP, or ZGY file to your seismic interpretation system without duplicating data.

"Companies can often read seismic data faster from a remote cloud server in VDS format, than they can if the data is stored on their local hard drive in SEG-Y format," Mr. Piette says.

Customers like this because they may have concerns about "stranded applications", ending up with software and formats which are obsolete. Or they want to get more return from the investment in the software they already have.

"You have applications going to the data, rather than data going to the applications," he says. "That's a fundamental shift.

Background

Bluware was formed from the merging with two other companies in 2017, Hue AS and Headwave Inc.

Before that, Bluware had been an IT services company. Bluware started working with Shell providing IT services and built up a broader client base in the years up to the oil price collapse in 2014. Headwave and Hue provided geoscience services and software.

Hue had been in business since 2001. Bluware and Headwave had been in business since 1996.

As an IT services company, Bluware would deliver IT that clients asked for, such as a wavelet extraction routine, and the client would own the intellectual property of it. "We had a big group of people very experienced in oil and gas," Mr. Piette says.

Dan Piette, CEO, has been involved in subsurface digital technologies since 1988, when he joined Landmark. Since then, he has seen oil prices drop 50 per cent at least five times.

Every time it happens, "it seems like innovation comes," he says. "Every time we go through these cycles, someone has another brilliant idea."

Mr. Piette has a strong background in subsurface data integration projects. He is the former CEO of OpenSpirit, a company which aimed to help companies integrate subsurface data from multiple sources.

digital energy journal

Where geoscience goes next – opening session at EAGE Dec 2020

Senior exploration leaders from Shell, CGG, Rystad Energy and University of Texas shared their perspectives on where geoscience, and work for geoscientists, is going next, in the opening session of the EAGE 2020 annual event (online) in December

Marc Gerrits, executive vice president for exploration with Shell, sees geoscience as "the custodian of technical excellence in the subsurface."

"That has served the oil and gas industry very well," he said.

He was speaking at an online opening session of EAGE (European Association of Geoscientists and Engineers) annual event, held in December 2020 (see link to video below).

The value of geoscience will continue beyond oil and gas. "Any aspect of the energy transition that involves subsurface and subsurface technology will include expertise that comes from geoscientists," he said.

"CCUS, hydrogen storage, geothermal energy, all require an understanding of the subsurface. And an understanding of how to use the subsurface for the benefit of those future technologies as and when needed."

Marc Gerrits, executive vice president for exploration with Shell (photo from online event)

Meanwhile, "we will need geoscientists to continue to work with the oil and gas industry, which has multiple decades to go."

The oil and gas exploration market dynamics are changing to an orientation around "value" rather than "volume", Mr Gerrits said. In other words, it is no longer mainly about the number of barrels.

When considering a project, companies are comparing the financial breakeven of producing the newly found barrels, with the breakeven for producing barrels Shell already has in its reserves, he said.

Companies are also considering the "carbon resilience" of the barrels, such as the CO2 emitted when producing them, such as in pumping, transport or construction.

For any exploration projects, shooting new seismic, and more advanced seismic will be needed. "The seismic industry is an absolute partner in creating that value for oil and gas companies," he said.

Sophie Zurquiyah, CGG

At the moment, "clients are stopping and delaying significant investments that are required to maintain [oil and gas] production," said Sophie Zurquiyah, CEO of geoscience services giant CGG.

"I look at the number of studies that point to the need for oil and gas for the foreseeable future. In any scenario it is required as part of the energy transition."

Sophie Zurquiyah, CEO of geoscience services giant CGG (photo from online event)

"I believe the delays in investment that we're seeing now will result in shortages down the road - 2023, 2024."

Asked whether we are likely to see further consolidation in the geoscience services business, she replied, "there's a text book [answer] which says, 'when times are tough everybody is shrinking, the only solution is consolidation.' I'm not convinced, I think it depends on [the] individual situation. I see forks in the road. Depending on where your starting point is, the course forward might be different."

When companies are not seeing the growth they expected, or no growth at all, there are two pathways. One is to try to do more for existing clients, for example helping them do more with the "energy transition". The other direction is to look at new industry sectors where the company's competences would have value, she said. For example CGG is developing structural health monitoring sensors for buildings under