How edge computing will support digital transformation in the oil and gas industry

Improving operational efficiency is paramount in the oil and gas industry: it is capital intensive, price sensitive and (can) operate in extreme environments. Digital transformation has become critically important and is being aided by the rise of IoT, AI and AR/VR. In this article, we share our thoughts on how edge computing can also play a key role.

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The highly competitive nature of the oil and gas industry has been heightened by the present uncertainty around global demand for oil and natural gas. This has stepped up pressure on companies to reduce their operating costs and capital expenditure. At the same time, the industry is undergoing a digital transformation, due to the rise of the Internet of Things (IoT) and technologies, such as edge computing. The industry lags behind other industrial sectors, such as manufacturing, when it comes to digitalisation and automation, so the potential for IoT to be transformative still remains untapped. Companies must leverage this change in order to increase their productivity and cut costs, enabling them to remain competitive in today's market. One digital tool that will prove particularly useful is edge computing.

Edge will enable real-time analysis of data

Oil facilities produce huge amounts of data. A single oil rig can generate over a terabyte of data each day - the equivalent of 130,000 digital photos. However, less than one percent of this data is analysed and used to generate insights, most is left unused. The data that is used cannot be accessed in real time, as it must first be sent to a remote data centre, where the application is hosted and data stored. Assuming the data is sent via satellite link, it can take up to twelve days for a single day's worth of data to be transmitted from the oil rig to the data centre and, by this point, the data may no longer be relevant.

Edge computing solves this problem. It provides a way for the massive amounts of data being generated throughout the supply chain to be collected and analysed in real time. This is made possible even in the wide variety of environments involved in oil and gas extraction and processing, such as wellbores that reach deep underground, oil rigs in remote locations, and the intense temperatures of liquefied natural gas (LNG).

How will oil and gas companies benefit from edge computing enabled use cases?

Processing at the edge improves the use of condition monitoring and predictive maintenance. The decrease in the price of sensors and computing power has made it cheaper to monitor key components and processes; if there is any problem or unusual activity, it can be detected instantly. With edge computing, this data can then be analysed immediately, the cause of the issue identified and the appropriate actions taken to rectify the situation, ideally long before significant damage occurs. For example, if a leak was detected in the pipeline, it would be possible to use automated valves to isolate the area containing the leak and alert the maintenance team. Analysis is valuable throughout the whole supply chain, from reservoir models that maximise production to the ability to track resources as they progress through pipelines, processing facilities and downstream distribution. Digital models can also learn continuously to further increase the efficiency of operations, ideally in a predictive rather than reactive way. This results in huge improvements to the safety of workers, as well as an additional safeguard for critical infrastructure and the surrounding environment.

There is also a significant reduction in downtime. For an LNG facility, a single day of downtime can cost $25 million and this occurs an average of five times per year. The ability to reduce downtime leads to massive cost savings and provides a significant commercial advantage. Predictive maintenance not only reduces unplanned downtime by reducing instances of equipment failure, but also minimises the duration of planned downtime by making it possible to predict maintenance windows for equipment.

The costs savings do not only come from reduced downtime. Because the data is being analysed at the edge, it doesn't have to travel back to the data centre, so network costs are reduced. Maintenance costs are also minimised; predictive maintenance mitigates the risk of significant damage to equipment and can remove the need for a technician to physically visit the site to address maintenance and repair issues.

The industry still faces challenges with edge

Developments in machine learning and advanced analytics are driving the value of edge computing and increasing the scope of how it can be used in the oil and gas industry. This is being furthered by developments in technology such as microcontroller units (MCUs)- components of many edge solutions that are simple, cheap and require minimal energy consumption.

However, the implementation of edge-based solutions for the oil and gas industry does not come without challenges. The introduction of a new technology to an ageing workforce exposes the skills gap that currently exists. Companies will need to make an effort to provide the appropriate training to upskill workers. A change in company culture will also be required, as finance/budgeting, operating models and processes will need to adapt incorporate new cloud-like and data-driven solutions about the supply chain and operations.

The increase in big data will also raise questions surrounding ownership of data. While it is relatively straightforward that the output (oil and gas) belongs to their operators, the ownership of the associated data is less clear cut. The data that is captured throughout extraction and processing (in rigs, pipelines and pumps) contains valuable information that could be useful for the industry, but the potential remains untapped. In particular, there is lack of clarity when AI systems are involved, as the learning system may be owned by a different company to the one that owns the resulting data. The developers of machine learning algorithms face a further challenge – they need a minimal about of data to create valid algorithms, however they currently lack much of this historical data. This is partly due to the fact that data has not been stored in a way that makes it accessible in the past.

Despite the various challenges, it's clear that edge computing has the potential to transform the oil and gas industry, through its ability to unlock data insights and ultimately improve the safety and efficiency of operations. If companies are able to overcome the challenges associated with its implementation, they will benefit greatly.

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