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Big Data Analytics in Oil & Gas Industry

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Abstract: The Oil and Gas industry, known for its speedy acceptance and ability to acclimatize to the new technological developments of the modern era, has entered a new cohort of transformation with the introduction of big data analytics. With harder way in to assets yields and even harder forecasting shortcomings, it is crucial to collect and maintain data efficiently. The amount of data being generated is now growing by a large factor and it is being gathered and used as never before with today's technology.

This paper focuses on the various ways that make it easy for an energy firm to gather, understand, and influence the disparate statistics. Big data analytics for Oil & Gas equips with the ability to utilize operational data to drive practical E&P, build confident decision-making to statistically predict productivity and efficiency across all major business units through the best practices for data management, equipment maintenance to adjust repair schedules and anticipate breakdown, production and price optimization using scalable technologies to determine commodity pricing and safety and compliance using weather and workforce scheduling data to avoid creating hazardous conditions for workers and mitigating environmental risks.

1. INTRODUCTION

Big data usage in the form of traditional resources such as equipment monitoring schema or maintenance records and previously unused sources such as seismic statistics inputs, weather research patterns or an amalgamation of these sources of data can lead to interesting insights that empower decision-makers who rank among the leaders of oil and gas sector to gain market advantage. The facility to access and draw rich insights from the data sets is at the heart of productivity in the oil and gas industry and hence, big data analysis plays a huge role. It includes using data from pumps and wells to recover equipment use, management and construction volumes, and using weather monitoring and workforce scheduling data to alleviate risks.

Unleashing the power of data with proper information organization and analytics resolution can facilitate oil and gas industry to use information advantageously to trim down operating costs and perk up all areas of the oil and gas lifecycle.

2. PURPOSE OF BIG DATA

Innovations in O&G tech have the potential to impact everyone. Technology has made oil and gas sector safer, cleaner, and cheaper to extract, presenting a huge business opportunity to the big firms. The advancements in digital oil fields demand for big data acquisition and analysis on a large scale. The basic premise of a digital oil field is an online real-time platform from which all of the data coming from all over the oilfield can be managed, evaluated, and tracked effectively. There are wide sub divisions in an oilfield where huge amounts of real time data gets gathered to give an estimate about the

future statistics as well as to keep a track on the on-going proceedings. Basically, there are a few shortcomings that are easily overcome using big data analysis in an efficient way. Some of them are:

- Cost optimization in oilfield processes
- Exploration and production know how on real-time basis
- Maintaining storage facilities
- Commodities transportation look abouts

- Combining data from geophysics, geology and engineering fields to present a collectively synchronized information

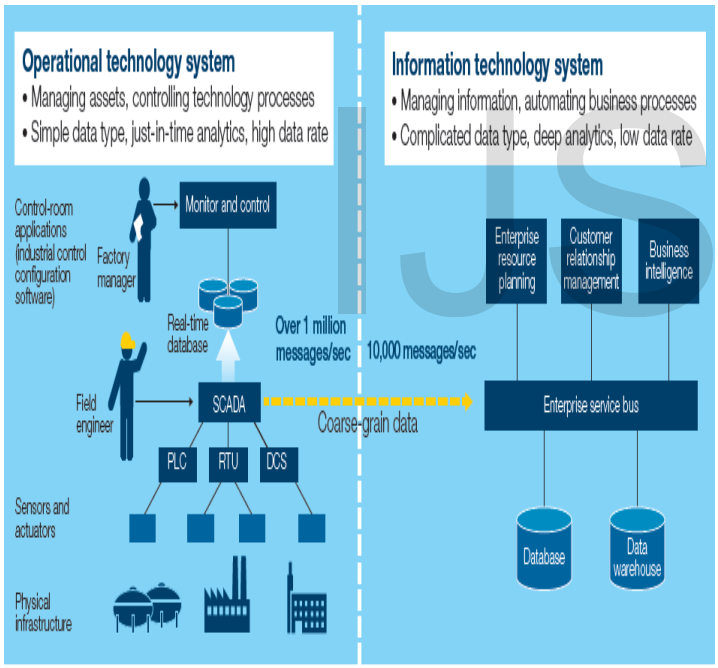

Fig1. Integration of IT Systems

2.1 Smarter sensors and optical fibres for wells

A reservoir well produces around one terabyte of data and every productive well generates data equivalent to Wikipedia's text every week. Hence, Oil and gas site wells need monitoring on a constant basis. Video is used with smart sensors for many applications to get analog readouts of pressure and measuring flow rates of reservoir wells. In fact, as the industry drills more horizontal wells, with more stages, the data generated by those operations grows even larger. With augmented multi-stage fracking activities, companies are demanding more 3-D seismic data to pinpoint prospective drilling areas using big data. Optical fibres are lowered within the wells for data acquisition on more robust platform. Optical fiber cables are supplied with sensors that measure everything within the wells. With this data, analysis of how the wells are doing and how much oil or gas is still left is done quite easily and successfully.

2.2 Data from Pipelines

The big data from pipelines in oil and gas industry is being used to get information of pipelines that are prone to accidents, and how much volume is moving through them and at which flow rate. Now -a-days, fibres are being used alongside oil or natural gas pipelines that would transmit real-time data to operators at the main consoles. The benefits of having fibre follow pipelines includes bringing higher bandwidth to remote areas, giving them the bandwidth and thus, helping in gathering more amount of real time web -based data. And as far as security is concerned, more video analysis would assist the practice of monitoring drones or having manual labour simply come and check the reliability of the lines periodically.

2.3 Permanent Reservoir Monitoring

3D seismic data processing has been very common in the oil and gas industry for many years, modern developments in the field have added a new technology called Permanent Reservoir Monitoring, or PRM. It takes assistance from the most cutting-edge HPC technologies. Previously, the development

strategy for a newly discovered field was based primarily on the original seismic data, but recently performing multiple seismic surveys has enabled detection and follow changes in reservoir reflectivity caused by the movement of injection and production fluids. These data-intensive approaches contribute to Permanent Reservoir Monitoring.

The time-lapse seismic, or 4D-seismic surveys data, are integrated with the ongoing new stream of production data to continuously improve the accuracy of the reservoir model of the field. The end result is a situation in which production companies get hold of a major unstructured big data that requires innovative high-performance computing models to get the job done for further processing.

2.4 MICRO-SEISMIC TECHNOLOGY

In addition to the conventional forms of scrutinizing, micro-fractures in rocks during hydraulic fracturing are monitored to understand how the fields produce. This extra knowledge of rock and shale characteristics can make reservoirs profitable, extend oilfield life and lead to fewer operating mishaps.

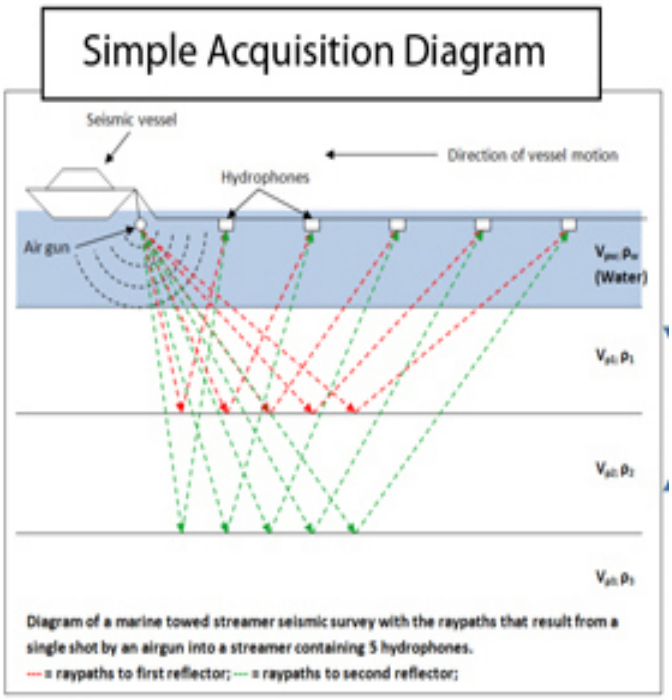

Fig2. Big Data ACQUISITION USING SCADA

3.BIG DATA ENTERPRISE DEPLOYMENT

A seismic dataset is typically in the hundreds of gigabytes, resulting in terabytes once the processing and interpretations are finished. For this, big data is analyzed in a synchronized manner and hence initiatives are deployed systematically.

3.1 EXPLORATION

When exploring, big data and the use of advanced analytics techniques merge to perform for identifying seismic trace signatures. The analytical tools linked with big data can benefit the O&G exploration by enhancing searches as they combine enterprise data with real-time production data to showcase new insights as well as by assessing acreage by generating new prospects as they create competitive intelligence using geospatial data and other syndicated information as resources. The geologists and

petrophysicists use seismic data produced by sending sound waves deep into the subsurface.

For exploration, the R&Din geophysics of the area centers around acquisition, processing, interpretation and hardware optimization. Well log data is also captured for gathering the information and is interpreted to produce specific information about the rock that is operated on and the fluids that exist around or inside it.

3.2 PRODUCTION

Production in oil and gas involves drilling and completing the wells as well as connecting them to pipelines and then keeping the flow of commodities at an optimum rate by integrally relating all of the processes to the subsurface environment. Advancing operations can appreciably decrease costs. However, optimizing production is reliant on the type and structure of the reservoir. These decisions depend on models created in the exploration phase mostly using the big data . The area of production is most likely the fastest growing in terms of the volume, variety and velocity of data being collected. The real-time information returned from supervisory control and data acquisition (SCADA) systems can be used to look for opportunities that maximize and optimize production.

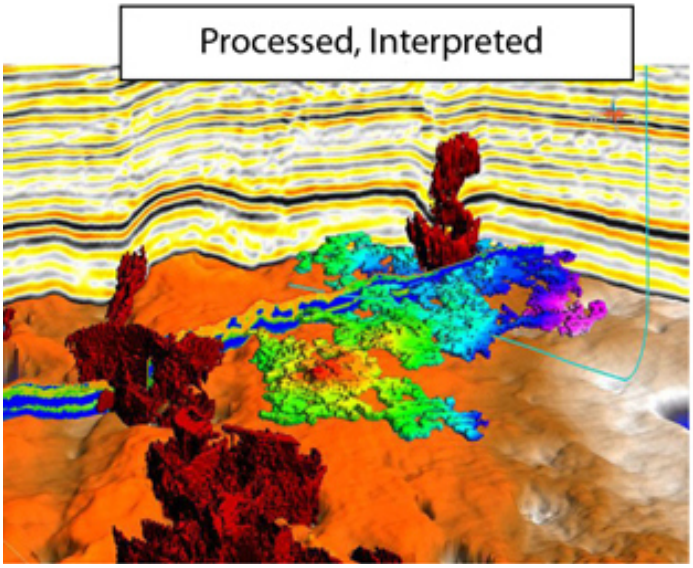

Fig3. A processed, interpreted 3D seismic Earth model

CHALLENGES:

With growing data volumes, it is vital that real-time information that is of use to the business can be extracted, otherwise the risks being swamped by a data deluge. Along with many opportunities, big data comes with a many challenges owing to its complexity. One challenge is how we can use big data when it comes in an unstructured format. Another challenge is how we can capture the data as it happens and deliver that to the right people in real-time basis. Third challenge is storing, analyzing and understanding data. And there are several other challenges, from privacy and safety to access and deployment. The problem of integrating lots of data at different scales with different types is a critical need to get the most. All the data is of course impossible to understand correctly if not properly visualized.

CONCLUSION

Using big data to gain new insights improves the bottom line and leads to true competitive advantage in the oil and gas sector. The stake holders need to spend in the appropriate technology components to support their big

data initiatives. The O&G companies are beginning to create big data initiatives from exploration and production to oilfield services and transportation. Top companies are designing and deploying technology that can help them pursue new business opportunities, reduce costs, and streamline operations. By following the recommended steps outlined in this paper, O&G firms can plan and execute big data initiatives, both large and small, in ways that deliver maximum value.

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