A System Implementation for Retaining and Analyzing Seismic and Well Data Based on Big Data Techniques

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ABSTRACT

The oil and gas industry by all means is a data-driven industry as it depends heavily on the information technology. For the past decades, the industry has dealt with fast-moving and voluminous amount of data in quest to learn about subsurface for speeding up hydrocarbon finding, enhance oil and gas production and reduce health and safety risks. According to Saudi ARAMCO's data center for Exploration and Petroleum, statistics show that the amount of data coming from upstream only is doubling every two years. It is imperative for oil and gas firms to understand and leverage this data in order to maintain competition in planning, exploration, delineation and field development. However with the traditional relational database technologies, oil and gas companies are generating data at a rate that often exceeds their ability to process, retain and analyze it effectively.

Recently, new Big Data technologies including NoSQL databases and Hadoop have evolved to quickly search and analyze large volumes of data with competitive intelligence that can substantially lead to an improved strategic decision making at reasonable time. Elasticsearch, in particular, is a distributed and extensible database system with integrated full-text search engine that was specifically designed to handle big data search at performance relational databases were simply never aimed to support. In this paper, we present a novel system architecture and implementation for structuring and indexing seismic and well data employing Elasticsearch as main underlying technology. This system maintains data integrity and durability while providing fast and intelligent search services that retains seismic and well data in an application-friendly format. Moreover, it was further integrated with ArcGIS map services to provide direct map visualization of the retrieved seismic or well data. Finally, we conclude by an overall assessment with emphasis on security and performance aspects of this system. Practical experiments show by numbers that the proposed system performs 10 times faster than traditional database systems when comparing data retaining speed.