High-Performance Visualization Software and Research for Oil & Gas Industry

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In 2011, the total revenues of the five major oil companies were almost US$ 2 trillion, which was more than Russia's GDP (Gross Domestic Product). My company, BP, posted $390 billion revenue that was not far from Taiwan's GDP, $480 billion. According to a study, more than 6000 products are made from Petroleum. Furthermore, the oil and gas industry is composed of hundreds of firms of various sizes doing business in different aspects of the oil supply chain. Therefore, the oil and gas industry not only dominates global economy, but also strongly affects human life.

To find oil or gas, geoscientists examine a variety of data types. Seismic data is generally used to identify continuous reflections, represent horizons, discontinuities, faults or other structural components that form the structural framework of reservoirs that entrap hydrocarbons. This data type provides high resolution horizontal information, but lacks vertical detail. During an oil and gas exploration, wells are drilled that provide petrophysical and geological information from wire-line logs and cores. The well data provide high resolution vertical information, but does not provide detailed horizontal information in the inter-well space. With sophisticated earth modelling tools, these two data types can be integrated, thus optimizing the horizontal resolution of the seismic data and the detailed vertical resolution from well data. The coalescing of these data by geoscientists and engineers results in the static model from which we can build reservoir simulation models that predict the oil and/or gas fluid flow, and facilitates hydrocarbon production planning.

For many years, geoscientists have routinely used 3D visualization software to look at all kinds of recently described data for oil and gas exploration. The value of visualization has been highly proven and recognized in the oil and gas industry. A 3D interpretation software can even make multi-millions US dollars in a year. The successful visualization products are built with many well-established visualization techniques such as scene graph, volume rendering, generation of iso-surface, etc. The consistent research and innovation of visualization techniques are the key factor to maintain lead in the oil and gas software business.

In this talk, I will briefly introduce the Oil & Gas visualization and applications first. Then, I will discuss our applied fundamental visualization techniques such as Java-based scene graph, volume rendering, and iso-surface generation, etc. The research and innovation we have done recently will be described in detail next. Finally, I will present my future works and research plans.