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Maritime Data Integration Using Standard ISO 15926

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ABSTRACT

The Oil & Gas industry is moving forward with Integrated Operations (IO). This includes a strong focus on data integration issues. There are different ways to achieve data integration, and ontology-based approaches have drawn much attention. For maritime data integration, the international standard ISO 15926 has been developed to integrate and represent the information in and across process plants. In this article, we follow the ontology-based approach and use the ISO 15926 standard as well as Semantic Web technologies to implement maritime data integration, to see how well they fit together and prove the benefits they can bring for the next generation of Integrated Operations.

KEY WORDS: Data integration; ontology-based integration; ISO 15926; Semantic Web; Oil & Gas ontology; Integrated Operations.

1 INTRODUCTION

Modern Oil & Gas industry is to a large extent a knowledge and information industry. It is moving forward with Integrated Operations (IO). The Norwegian Oil Industry Association (OLF) has defined the term IO as "real time data onshore from offshore fields and new integrated work processes". Thorsen and Rong (2008) have mentioned that IO consists of collaborative efforts in the Oil & Gas industry to support operational decisions about offshore installations by onshore control centers, developing common standards, integrated solutions, and new technologies. The first generation of Integrated Operations (IO G1) has integrated processes and people offshore and onshore, improving the ability to support offshore operations from onshore centers. The second generation of Integrated Operations (IO G2) aims for heavily instrumented facilities, heavy automation and multi-domain optimization of processes. Thus, to solve the problem of vast human interaction involved in exchange of data and facilitating the information interoperability between multi domains will be difficult. In other words, data integration will still be a significant topic during the second generation of Integrated Operations.

Within the Oil & Gas industry, data integration, also known as information integration, involves gathering and combining data residing in multiple heterogeneous data sources (like different offshore databases) and presenting these data in a unified view to users (like onshore control centers) in order to achieve the transparent manipulation of information. How to tackle the data integration problem in the Oil & Gas industry is our main topic in this paper.

There are different approaches to realise data integration. Ziegler and Dittrich (2004) separated the data integration approaches into different abstraction levels: (1) manual level, (2) user interface level, (3) application level, (4) middleware level, (5) data access level, (6) data storage level. For manual data integration, all the integration work is done by the end users. With a common user interface, end users could use an interface like the World Wide Web to make a query. Application level approaches rely on applications to do the integration job. Middleware provides reusable functionality used to solve dedicated aspects of the integration problem. For the uniform data access approach, a unified global view of distributed data is provided. The common data storage method has to transfer data to a new data storage with local ones being abandoned or remaining operational.

There are three well-known models of data integration: federation, warehousing and mediation (Sheth and Larson, 1990; Prasad and Reddy, 1994; Hernandez and Kambhampati, 2004; Aldana et al., 2004).

In federation, database systems are distributed and independent, preserving database autonomy. Database systems communicate to each other directly and data can be retrieved via a middleware component. Federation is considered as a middleware level data integration approach.

In warehousing, data must be extracted, transformed and loaded from remote sources to a local central repository named "data warehouse". The central repository provides a single access point to a collection of data obtained from heterogeneous sources. Warehousing is considered as a data storage level integration approach.

In mediation, a mediator does not store any data on its own. It rather provides a virtual view of the integrated sources. Wrappers are often used to translate data access and manipulation requests between the mediator and data sources. The mediator splits a user query into sub-queries, sends the sub-queries to appropriate wrappers and integrates the query results locally. Mediation is considered as a data access level integration approach. As Hieu (2005) said, the mediation model is usually more flexible than the other two. It can deal better with autonomous and frequently changing data sources.

Another way to categorize data integration approaches is according to heterogeneity handling. There are mainly three kinds of data