Position paper for the W3C Workshop on the Semantic Web in Energy Industries Part I: Oil&Gas

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1 Introduction

National Oilwell Varco is a supplier of machinery and information systems for the Oil and Gas industry. A vast majority of the drilling rigs in operation today have equipment supplied by National Oilwell Varco, and always in a unique configuration in order to work with machinery and information systems by other vendors. There are many technology shifts over the lifetime of a rig. Whole or partial upgrades create a large workload to keep the rig in operation. Additionally, the representation of the operational state of the rig is specific to each rig making information integration challenging and error prone. Semantic technologies can help in reducing the complexity of the challenge and make interoperability more manageable. Leveraging semantic technologies, we see a way forward to improve integrated operations between vendors and also reduce the workload of evolving the systems by basing our solutions on a firm foundation.

2 Use Case: Condition based maintenance

Maintenance of rig equipment is currently done by specifying a maintenance time span and then sending the equipment in for inspection or even unconditional replacement. By taking the current state of the equipment into account, maintenance can be triggered when required. Not only can this save costs but also increase safety.

Many parties are involved in a typical maintenance scenario. A large amount of data has to be shared between drilling contractors, rig operators, certification agencies, transportation providers and so on. Each has its own legacy system, and currently there is low interoperability between the systems owned and maintained by the involved parties. The sheer number of involved parties alone creates a considerable management challenge.

By introducing a shared, extensible and consistent vocabulary allowing the description of the state of the maintained equipment to be shared, we believe

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the interoperability effort between the involved parties is much less risky, easier to manage and more robust to change.

Additionally this provides an opportunity for data analysis providers, because we believe that the data that the analysis is based on will be much easier to access. The shared, extensible and consistent vocabulary simplifies the task of making the results available.

From the perspective of a large multinational company, this effort should also help us to coordinate easier internally.

3 Use Case: Controlling the drilling process

Currently data integration on a drilling rig happens on a very low level. That creates a big overhead of integration work when introducing new machines and novel operations. One obvious example is an anti-collision system on the drill-floor where machinery comes from different vendors. This anti-collision system is created specifically to each rig, dependent on how each machine reports its position, breaking distances and so on.

More sophisticated distributed and automatic advisory and decision making is very expensive due to the large effort that has to be undertaken to extract state from each machine. The business however, moves forward to distributed control. Solving this challenge will thus be beneficial for both the supplier industry and its customers.

Also here we see that by establishing a shared, extensible and consistent vocabulary we think we can simplify the integration scope compared to existing solutions. It makes it easier for machine vendors to expose machine state to interested parties. Since it is easy to get, more information can then be made available to advisory and decision making systems to improve the quality of the advice.

4 Applying Semantic Technologies

The traditional way to solve the challenges outlined in the previous sections is to create a standard that everyone is required to adhere to. There are several problems with this approach. The coordination required to create the standard is time consuming and without immediate results. Additionally, undiscovered weaknesses in the standard are very difficult to address after the standard has been published. This creates a bottleneck for innovation and increases the incentive to sacrifice interoperability for innovation.

A different approach is the utilization of semantic technologies. The key is a shared, consistent and extensible vocabulary. Here, a vocabulary is a set of symbols appropriate for the representation of the states for a given domain. An ontology describes the vocabulary in an ontology language, which allows automatic consistency checking of the vocabulary. Because of the automatic consistency checking, the coordination required to extend the vocabulary is much lower.

An information standard *ISO-15926, Industrial automation systems and integration - Integration of life-cycle data for process plants including oil and gas production facilities* has been designed with this goal in mind. It provides for-

mats and methods that support creating interoperable systems. It can act as a base to define vocabularies and ontologies. Several major companies support this standard with an international team of developers. The major advantage of the standard is the avoidance of fixed schemas and thereby allowing for change and development of the concrete representation.

5 Conclusion

We believe that Semantic Web technologies and the ISO-15926 standard is a firm foundation to build inter-operable systems in an extensible way. By taking an evolutionary approach using the methods and formats of the semantic web and ISO-15926 we reduce the risk making interoperable systems without inhibiting innovation.