Use Case 3 in Energy - Research
Petroleum Industry Needs

KW Partner: Institut Francais du Pétrole

1. Overview

Challenge
The domain of greenhouse gases mitigation presents a wide application potential and that it can provide a sound basis for developing the domain ontology needed for our semantic applications
Solution
Develop knowledge models for semantic memories and intelligence of CO2 mitigation
Why a Semantic solution

The development of semantic technologies will contribute to raising the knowledge level and improve the business processes in our critical applications areas.

Key Business Benefits
Better exploitation of the company asset
Sustainable development
Business Partners
Partners in exploration, production, transportation, refining, and use of hydrocarbon

Keys components

Existing Software
Knowledge Management tools with too limited capabilities

Research and development
Advanced KM tools

Technology locks
Data and Process automated integration
Automated annotation of multi-modal documents

With the publishing by the W3C of its Ontology Web Language, and with the many European and international projects related to semantic interoperability, the Semantic Web is turning into reality. One can foresee a world of web documents, data and services powered by domain ontologies, allowing wide communities of interest to share information and applications, thus reaching higher levels of collaboration, mutual understanding, and processing of many sorts.

IFP wants to be at the forefront in the definition and use of knowledge models for the energy industries based on semantic web technologies. Complementing the many existing projects on generic semantic web technologies, IFP intends to implement similar features in the petroleum and energy sectors, through technologically advanced industrial applications in exploration, production, transportation, refining, and use of hydrocarbon.

IFP and many partner organisations contributed significantly to establishing the state of the art in process and earth sciences applications. We coordinated a number of EC-funded projects which established the widely accepted CAPE-OPEN interoperability standard for process modelling software; we developed the advanced process monitoring and supervision system, CHEM, with applications in chemical, paper, refining and steel industries. We were involved from the beginning in the definitions of world standards for interoperability of petrotechnical data in the exploration and production domains (POSC, OpenSpirit…).

More recently, IFP initiated two projects relying on domain ontologies: the COGENTS project (Cape-Open aGENTS) where cognitive agents use an ontology of computer-aided process engineering to help in configuring process modelling applications; the EPISEM ACTION project in which an ontology of geological objects and of the associated processing workflows serves as the basis for integrating data and applications in petroleum exploration.

Our current concrete goals are to develop knowledge models for semantic memories and intelligence of CO2 mitigation, a key application target now that the Kyoto Protocol has entered into force. We will build ontologies and semantic software in the following application domains: processes (documents, flowsheets, chemical compounds, structures,

experimental results…) and earth sciences (documents, geological models, geophysical data, wells…).

At the moment, knowledge management in our industries is still very limited in functionality despite the claims of many tools providers. In most cases, industrial knowledge management in practice consists in shared storage for documents, shared workspaces, discussion fora and networks of experts. The development of semantic technologies will contribute to raising the knowledge level and improve the business processes in the selected critical application areas.

2. Applications related to greenhouse gases mitigation

Furthering these experiences, we now aim at wider semantic web applications related to processes and earth sciences. A key application domain is CO2 mitigation, i.e. how businesses and societies will come to grips with the severe problems caused by escalating emissions of CO2 to the atmosphere.. These consequences include raised atmosphere temperature, increased icecap melting, raised sea-level, increased frequency and severity of storms, etc. Unchecked, the development will negatively affect continued well-being and prosperity. Many programs have been started to find better ways of reducing CO2 emission, capturing CO2 before injected into the atmosphere, and safely store CO2 in large-scale reservoirs. Our ambition is to offer a common semantic basis and knowledge exchange platform for European CO2-related projects, and hence enable better use of intellectual resources and more rapid dissemination of new research and technology results. The user community includes directly participant at all levels of the projects involved, and indirectly other stakeholders, like government officials, other researchers and analysts, media, and the general public. Today, individual companies facing increasing concern for CO2 issues cannot find relevant and reliable information in a consistent manner. Many of those issues are non-competitive in nature, and the companies would welcome an offer for semantic sound knowledge hubs focused on CO2. The knowledge would include technical and factual information, best practices, models and modelling frameworks, as well as interpreted laws and regulatory information. Some of the key use cases for this domain are:

1. National and international regulations, agreements and treaties concerning CO2: to develop ontologies and tools helping to organise and extract knowledge on regulation concerning CO2, to facilitate its transfer to end-users, and to improve their understandability.

2. Semantic Model Roadmap: to apply semantic services and ontologies in order to break down process models into units that could collaborate and be reusable.

3. Ontology-based modelling: to develop mathematical models by describing objects of interest via an ontology, and generating mathematical equations automatically from the ontology-based description.

4. CO2 storage potential evaluation and monitoring: to support the evaluation of mature hydrocarbon fields and various other geological storage options as potential reservoirs for CO2 storage, thereby avoiding CO2 reaching the atmosphere.

5. Optimisation of communication and information flow in the CO2 capture and storage domain: to integrate the knowledge of CO2 capture and storage projects, to establish common project memories, and to link them with current developments in the CO2 storage domain on a global level.

6. CO2 Newsfeed clustering: to develop an automatic fine grain classification of news feeds about CO2 mitigation in a topics taxonomy.

7. Ontology based tools for CO2 emission and trade forecasting: to support planning and simulation by information retrieval, including multiple-source information into supportive tools, e.g. scenario forecast price developments, predicting CO2 emission as well as planning carbon credits. Ontologies developed for CO2 capture and storage can be seen as foundations for wider process and geoscience applications as the underlying concepts are the same.

3. Conclusion

IFP wants to be at the forefront in the definition and use of knowledge models for the energy industries based on semantic web technologies. Complementing the many existing projects on generic semantic web technologies, IFP intends to implement similar features in the petroleum and energy sectors, through applications in exploration, production, transportation, refining, and use of hydrocarbon. CO2 mitigation applications have been identified as main targets for the first developments, since they are both focussed on a domain important for our society, and generic enough to allow further use in other applications to processes and earth sciences. At the moment, knowledge management in our industries is still limited in functionality despite the claims of many tools providers. In most cases, industrial knowledge management in practice consists in shared storage for documents, shared workspaces, discussion fora and networks of experts. The development of semantic technologies will contribute to raising the knowledge level and improve the business processes in our critical application areas.

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