Integrated Operations and the Oil & Gas Ontology

Integrated Operations (IO)

OLF has defined the term IO as “real time data onshore from offshore fields and new integrated work processes”. OLF has estimated the economic potential of IO to be more than NOK 250 billions in NPV. OLF’s plan for implementation of IO - Generation 1 and 2:

- **Limited integration**
  - Traditional processes
  - Self-sustaining fields
  - Specialized onshore units
  - Periodic onshore support

- **Generation 1**
  - Integration across onshore and offshore
  - Integrated operations centers of operators and vendors
  - Heavily automated processes
  - 24/7 operation

- **Generation 2**
  - Integration across companies
  - Integrated operations centers of operators and vendors
  - Heavily automated processes
  - 24/7 operation

Oil & Gas Ontology

POSC Caesar Association (PCA), in close collaboration with the Norwegian offshore industry, has developed an Oil & Gas Ontology (terminology) for important upstream business processes:

- Drilling
- Development
- Production
- Operation

The Oil & Gas Ontology is stored in PCA’s Reference Data Service (RDS) and available on Internet free of charge. This ontology has been constructed according to the methodology and technology of ISO and World Wide Web Consortium (W3C) standards.
IO activities in OLF

OLF’s IO program is focusing on:

- Awareness
- Common cost efficient industry solutions

within the following four activity areas:

- Communication
  - Transfer of data from offshore activities to onshore operation centers
- Information Security
  - Baseline requirements for accessibility, confidentiality and integrity
- Data Integration
  - Data interoperability based on a common oil & gas ontology
- Implementations
  - IO goals for HSSE
  - IO requirements for operation in development and modification projects
  - IO requirements for operation of drilling rigs
  - Integrated work processes in drilling, production, operation and maintenance

IO areas addressed by OLF

I. Common digital platform

II. Best practices

III. Knowledge industry

IV. Overall business care

- Implementations
- Potential and consequences
- R&D on competence and digital products and services

Diagram:
- Subsea
- Oil platform
- Fiber cable
- Sensors
- Floater
- Data Integration
- Information Security
- Operators
- Digital Services
- Vendors
- Integrated operation centers
- Communications
OLF's IO Information Strategy

OLF’s IO Information Strategy has been developed for making it possible to implement IO Generation 2 which requires data sharing in real time among the stakeholders in any significant activity. The strategy has focus on Semantic Web (based on standards from World Wide Web Consortium (W3C)) and ISO standards.

A key element in this strategy is data integration across business domains of E&P’s value chain. Data integration provides:

- Improved data quality
- Improved data accessibility
- Significant cost reduction with change of software
- Increased flexibility with organizational changes
- Improved software functionality

Data integration requires a model or ontology (terminology for E&P) and preliminary set has been developed in close collaboration with the offshore industry and POSC Caesar Association (PCA). The ontology is administered by PCA and contains terminology from upstream business processes such as drilling, development, production, operation and HSSE.

OLF’s Information Strategy for Real Time Data Onshore

**Smarter solutions**

- Web portals
- Web services

**Common XML schemas**

- Field data
  - Health, safety, environment
  - Seismic
  - Drilling
  - Completion
  - Reservoir and production
  - Operation and maintenance

**Smarter data**

- Infrastructure for web services
- Oil and Gas Ontology (based on ISO 15926)

*Ontology = A hierarchical data structure containing concepts, relationships, properties and rules for a specific domain*
Data Integration and Oil & Gas Ontology

POSC Caesar Association (PCA) has, through ISO TC 184/SC4, developed a methodology for data integration across disciplines and phases. This work has been documented in ISO 15926 “Integration of lifecycle data for process plants including oil and gas production facilities”. The methodology is really a language consisting of a syntax part (ISO 15926 Part 2) and a semantic part. The syntax (or grammar) part together with domain terminology is used to develop ontologies for the different functional domains. These ontologies constitute the bases for consistent data integration within and across domains.

The methodology of ISO 15926 has been used in several research projects funded by Norwegian Research Council (PETROMAKS) and important stakeholders in the Norwegian offshore industry for developing an Oil & Gas Ontology. The Integrated Information Platform (IIP) and Intelligent Data Sets (IDS) projects - both managed by DNV - has made significant contributions to this ontology in drilling, development, production and operation. However, this ontology has to be maintained, enhanced and extended to cover all the domains in the E&P value chain. In addition, Web services (domain specific software) have been developed based on this ontology.

The what and how issues for the Oil & Gas Ontology are illustrated in the figure below.

Constructing Oil & Gas Ontology using ISO 15926
Why an Oil & Gas Ontology?

The offshore industry has huge economic investments in data acquisitions, analysis, visualization, documentation and archiving. Some of the data are in use for decades and it is one of the main assets. Organizational units and IT systems last rarely more than few years. The most stable element in this environment is the terminologies used in the business domains along the value chain.

Using the methodology of ISO 15926 it is possible to create ontologies from the terminologies in use in the offshore industry to:

- Do data integration within and across business domains
- Create an architecture for web services
- Include reasoning as a part of the ontology for creation of autonomous solutions
- Include uncertainty as a part of the ontology to cope with risks
- Be able to store data over time
- To use the ontology as a reference ontology (meta data set) to be used in-house and between companies
- To use the ontology in engineering

An Oil & Gas Ontology is a requirement for the implementation of OLF’s IO G2 as depicted in the figures below:

**Generation 1**

**IO Generation 1**
- Integrated onshore and offshore centers
- Intra-domain optimization of work-processes

**Ontology Generation 1**
- Terminologies for single domains
- The basis for XML schemas for automatic transferal of data between application in same domain

**Generation 2**

**IO Generation 2**
- Integrated operation centers of operators and vendors
- Heavily instrumented facilities
- Heavy automation and multi-domain optimization of processes

**Ontology Generation 2**
- Complete ontologies supporting automated reasoning or inference of data using logical rules
- Taxonomies for multiple domains
The Oil & Gas Ontology has to be maintained, enhanced and extended to cover all domains in the E&P value chain.

For the improvement of the Oil & Gas Ontology, PCA’s has established three different processes defined as levels of quality:

1. Submission of terminology from research or industry projects
2. Work-In-Progress (WIP)
3. ISO standard

The IIP and IDS projects mentioned above are examples of projects delivering terminologies of high quality. Special Interest Groups (SIGs) of PCA assure the quality of the deliverables from the projects within their domains. PCA’s Technical Advisory Board (TAB) access the quality across domains for WIP. To obtain status as an ISO standard (become a Part of ISO 15926) for the ontology in one or more domains, an ISO standardization process has to be carried out.

All three levels of quality are accessible from PCA’s web site (http://rds.posccaesar.com/) either through a browser or as a web service.

The three step process for improving the Oil & Gas Ontology is shown in the figure below.

The Oil & Gas Ontology might be express in several technologies like EXPRESS (ISO), SQL, XML, RDF and OWL. This makes it readily available for today's and future IT solutions.
How to participate in developing the Oil & Gas Ontology?

OLF

OLF’s IO program is running the following ontology projects:

- Daily Drilling Report (to be implemented on the NCS by October 1, 2007)
- Monthly Production Report
- Environment Report together with the offshore industry, authorities, the IIP project and PCA, and
- RDS project together with The Norwegian Ministry of Defence, PCA and DNV.

Participation in OLF’s project is open for all members of OLF, authorities and unions. Others can participate only by invitation. If you need further information, please contact: Thore Langeland, Manager IO, by email: tla@olf.no or by mobile +47-9095 1756.

PCA

PCA has several activities related to the Oil & Gas Ontology.

Technical Advisory Board (TAB)
The members of TAB are the chairpersons of the SIGs plus a few other specialist in ISO 15926 methodology specially invited by PCA's General Manager.

Special Interest Groups (SIGs)
All SIGs are open for participation for all members of PCA.

- SIG Modelling, Methodology & Technology (SIG MMT)
  Chaired by DNV, UiO, Vestlandsforskning
- SIG Health, Safety, Security & Environment (SIG HSSE)
  Plan to start up in 2008
- SIG Drilling & Completion (SIG D&C)
  Chaired by NOV, IRIS, UiS
- SIG Development & Modification
  Chaired by DNV
- SIG Subsea Equipment (SIG SE)
  Chaired by FMC
- SIG Procurement & Logistics
  Plan to start up in 2008
- SIG Reservoir & Production (SIG R&P)
  Chaired by EPSIS, StatoilHydro, UiB
- SIG Operation & Maintenance (SIG O&M)
  Chaired by StatoilHydro, IBM

If you need further information, please contact
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The Norwegian Oil Industry Association (OLF)

OLF is a professional body and employer’s association for oil and gas companies and the supply industry engaged in the field of exploration and production of oil and gas on the Norwegian Continental Shelf.

OLF’s task is to lead the industry’s joint effort for development of a progressive and competitive petroleum industry with a good reputation and good connections with the authorities, stakeholders and public opinion. OLF is heading a joint industry initiative on Integrated Operations (IO) initiative on the Norwegian Continental Shelf (NCS).

More information on IO on OLF’s web site: http://www.olf.no/io/

POSC Caesar Association (PCA)

PCA is the leading global, not-for-profit, standardization organization for the process industry including oil and gas, developing technology and solutions for Data Integration and Reasoning based on ISO standards and Semantic Web technologies.

PCA has the Intelligent Property Rights (IPR) and the administration of the Oil & Gas Ontology

More information on Oil & Gas Ontology on PCA’s web site: http://www.posccaesar.com/.