Enabling End User Access to Big Data in the O&G Industry

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Paradigm Shift for Data Access

Budget: 13 800 000 €
Running until November 2016
10 partners
5 countries
100 man years
FP7 Large-scale IP project

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Plan

O&G Big Data challenges
The Optique mission
Use case at Statoil Exploration
O&G expert access to Big Data
Big Data Challenges

Velocity

Volume

Variety

Complexity

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O&G Information Challenges

Complexity drivers:
- Many disciplines
- Many locations
- Requirements – standards, regulations, customer demands
- Asset management – lifecycle data

Data storage and access mechanisms:
- Proliferation of data formats and models
- Application dependent data
- Limited tools for end users
O&G Disciplines

Administration
Procurement
Civil/architect
Drilling
Electrical
Project control/economy
Geology
HVAC

Instrumentation/metering
Marine operation
Inspection
Piping/layout
Material technology
Structural
Operation
Process

Quality management
Mechanical
HSE
Telecommunication
Subsea
Weight control
Reservoir
Pipeline

(NORSOK, 1996)
Top-down Perspective
on O&G Corporate Data

Promote uniformity across the enterprise.

- Production of information
- Use of information
- Hand-over of information
Experts are *still* struggling with spreadsheets and ad hoc filters/look-up tables.
“A quite common situation in several or all my projects so far, I’ve had the need to check and cross check data which in our current tool was quite difficult, perhaps combine the data between tables and hopefully not having to do it in Excel all the time.

However, the program had an option to do SQL based searches. As few or none of the engineers know SQL coding, I had the IT support or system support make me the SQL string that was needed in order to make a specific search, and I then copied it into a text field so that I could use it later or try to modify it.

This is quite common for several of my engineers in similar positions as I had.”

Experts spend too much time collecting data
Bottom-up Perspective on O&G Corporate Data

- IT staff become critical engineering project resources
“In my area of interest, return the wellbores that penetrate chronostrat unit C1 and return information about the lithostratigraphy and the hydrocarbon content ...in the wellbore interval that penetrates the C1 unit.”
From Prospects to Projects in a Data-driven Process

Number of projects

Screen → Evaluate → Negotiate → Evaluate → Plan → Drill → Appraise

Generated Cost / Data Volumes

Project Archive
2D Seismic
Other sources

Licenses
3D Seismic

Exploration Wells
Delineation Wells

Production: Final Decision

Optique
Query development may take several days
Including other sources in queries is difficult/impossible
New **Expert Friendly** Interface

Optique

- **Expert**
- **Optique Application**
- **Ontology queries**
- **Automated Translation**
- **SQL queries**
- **Sources**

**timely, complete, and correct results**
Existing Systems and Sources

- IOHN
- LIFE of a WELL
- EqHub
- Integrated Environmental Monitoring
- NORWEGIAN PETROLEUM FACTS
- ERH™
Ontology-based Data Access (OBDA)

Ontology:
- Knowledge of concepts and relationships
- Understandable by humans & computers
- Integrating multiple domains

Mappings:
- View data through the ontology
Ontologies at O&G Complexity are now Practical

- Mature tools for building and verifying ontologies
- Exponential improvement in reasoner efficiency

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(Horrocks 2012)
Optique Architecture

End-user

Application

Query Formulation

Ontology & Mapping Management

IT-expert

Data models
Std. ontologies

Ontology

Mappings

Query Transformation

Query Planning

Query Execution

Stream Adapter

Query Execution

streaming data

cross-component optimization
Optique Architecture

**Zoom-in**

**Optique Platform:** Integrated via Information Workbench

- **Presentation Layer**
  - Query Formulation Interface
  - Ontology and Mapping Management Interface
  - Ontology editing Interface: Protégé
  - Optique's Configuration Interface

- **Information Workbench frontend API**
- **Stream connector**
  - JDBC, Teiid

- **Application Layer**
  - **Query Formulation Processing Components**
  - **Ontology and Mapping Manager's Processing Components**
  - **Query Answering Component**
  - **Ontology Processing**
    - Ontology reasoner 1
    - Ontology reasoner 2
    - Ontology modularization
  - **Query transformation**
    - Query rewriting
    - Semantic QOpt
    - Syntactic QOpt
    - Materialization module
  - **Component Manager, Setup module**
  - **Federation module**
  - **Optimization module**
  - **Manager**
  - **Shared database**

- **Data, Resource Layer**
  - RDBs, triple stores, temporal DBs, etc.
  - Cloud API
  - Stream connector
  - JDBC, Stream API

- **Components**
  - Front end: mainly Web-based
  - Group of components
  - API

- **Colouring Convention**
  - Optique solution
  - External solution
  - Application receiving answers

- **Types of Users**
  - Expert users
  - End users

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* E.g., widget development, Java, REST
Incremental Implementation

- Build on the data you have today
- Leverage processing power of existing systems
- Engage people to develop knowledge and capabilities
Optique Partner Programme

- Network Partner
- Discussion Partner
- Pilot Partner
Optique introduces new *technology* and new *ways of working*.

- More efficient enterprise knowledge workers
- More efficient IT operations
- More efficient enterprise information management
Optique

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