

# Analytics and scalable data access: the future of industrial information technology

Mobilizing fundamental research to digitalize industry

David Cameron, Centre Coordinator,  
SIRIUS Centre for Research Based Innovation, University of Oslo  
Optique Summit, Oxford, September 2016

# 2005?

- During 2001/02, leading enterprises will increasingly use a **centralized data warehouse** to define a **common business vocabulary** that improves internal and external **collaboration**.
- Through 2003/04, data quality and integration woes will be tempered by **data profiling technologies** (for generating metadata, consolidated schemas, and integration logic) and **information logistics agents**.
- By 2005/06, **data, document and knowledge management will coalesce**, driven by **schema-agnostic indexing strategies** and **portal maturity**.

Doug Laney, Meta Group AD949,  
6<sup>th</sup> February 2001

# Collaborative research centres are a good idea

- SIRIUS
  - Centre for Research-Based Innovation
  - 8 years (5+3) financing from Research Council of Norway
- Not a new idea:
  - Canada and Australia set them up in the 1990s.
- Already third generation in Norway
  - Integrated Operations Centre in Trondheim
  - DRILLWELL in Stavanger
  - Subpro in Trondheim



# Trying to keep two masters happy

Both cardinality constraints  $\geq 2 \text{ boss} \sqsubseteq \perp$  and  $\text{Project} \sqsubseteq \geq 3 \text{ worksOn}^-$  require a more powerful language. Finally, we have to say that a top manager manages exactly one project and also works on that project, while a project is managed by exactly one top manager. In *OWL 2 QL*, we can only write:

$$\begin{aligned} \exists \text{manages} &\sqsubseteq \text{TopManager}, & \exists \text{manages}^- &\sqsubseteq \text{Project}, \\ \text{TopManager} &\sqsubseteq \exists \text{manages}, & \text{Project} &\sqsubseteq \exists \text{manages}^-, \\ \text{manages} &\sqsubseteq \text{worksOn}, \end{aligned}$$

but not  $\geq 2 \text{manages} \sqsubseteq \perp$  and  $\geq 2 \text{manages}^- \sqsubseteq \perp$ . We cannot, obviously, represent constraints such as  $\text{CEO} \sqcap (\geq 5 \text{ worksOn}) \sqcap \exists \text{manages} \sqsubseteq \perp$  (no CEO may work on five projects and be a manager of one of them) either.





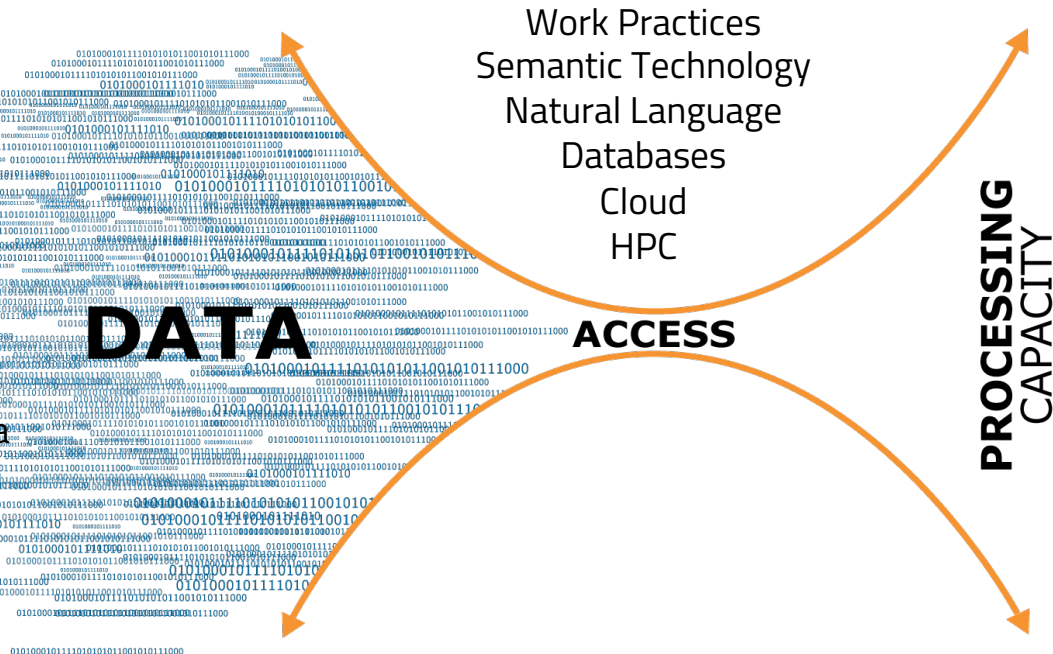
# Scalable data access in the oil and gas domain?

<b>Problem scope</b>	Toy problems	Realistic pilots	Enterprises
<b>Adoption</b>	The evangelists	The converted	The people
<b>IT operations</b>	On-premises	Outsourced	Heterogeneous
<b>Problem size</b>	Megabytes	Gigabytes	Terabytes
<b>Decision speed</b>	Weeks	Hours	Seconds
<b>Data complexity</b>	Single databases	Local silos	Corporate data
<b>Computing power</b>	Commodity	Terascale	Exascale
<b>Innovation</b>	Basic research	Applied research	Products and services



# Scalable data access in the oil and gas domain

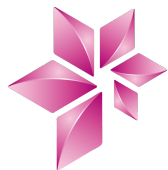
- Different formats
- Old software
- Complex, inconsistent data models
- Inefficient access methods
- Access and security
- Unstructured data
- Missing data
- Poor-quality data
- Too much data
- Manual work processes



- ... Accessing data
- ... is a technical
- ... and
- ... organizational
- ... bottleneck for
- ... using data.
- ... We make poorer
- ... decisions and
- ... waste time on
- ... tedious work
- ... getting data.



# Scalable data access in the oil and gas domain



Statoil



Schlumberger

ORACLE®



DNV-GL



NUMA SCALE  
BIGGER DATA ANALYTICS

EVERY



KADME



OSIsoft.

fluidOps



UiO : University of Oslo

[ **simula** . research laboratory ]

NTNU

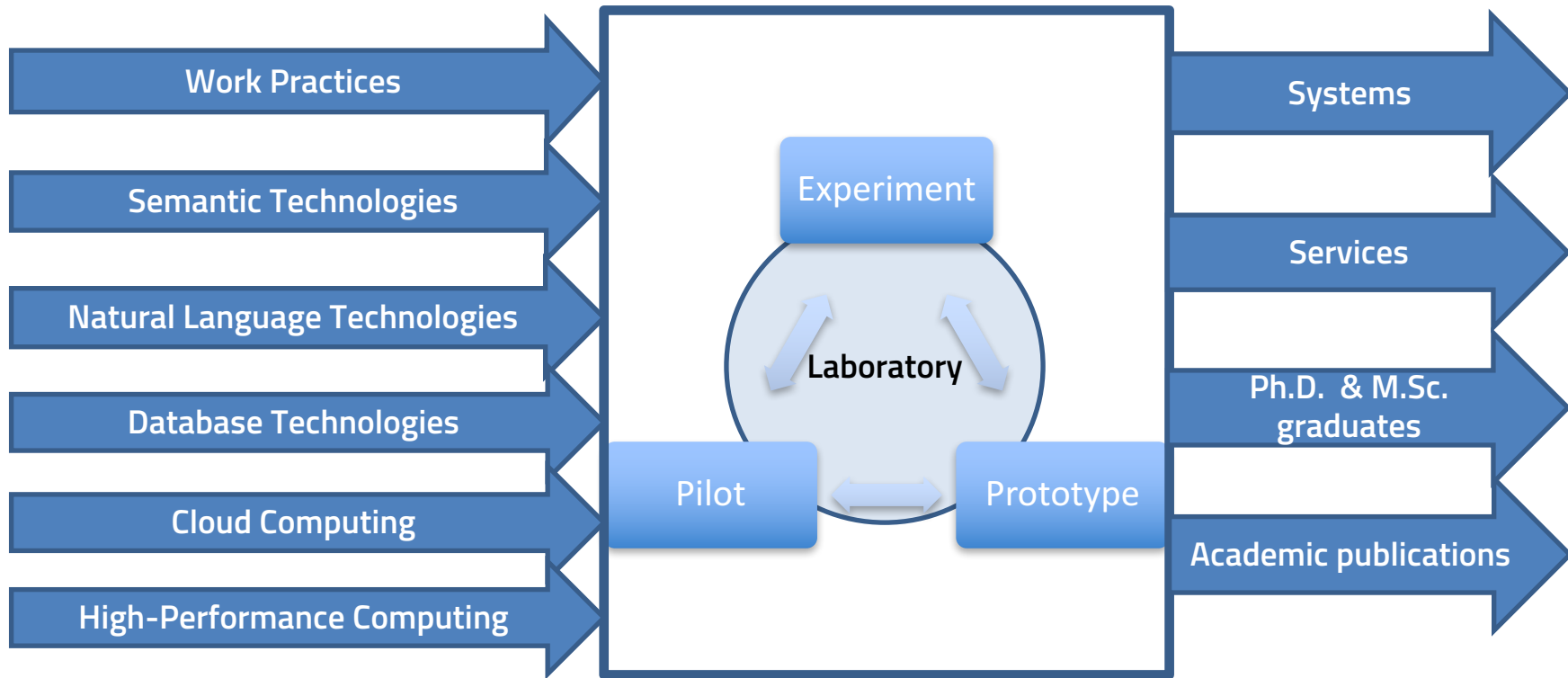
Norwegian University of  
Science and Technology



DEPARTMENT OF  
**COMPUTER  
SCIENCE**



# Scalable data access is interdisciplinary



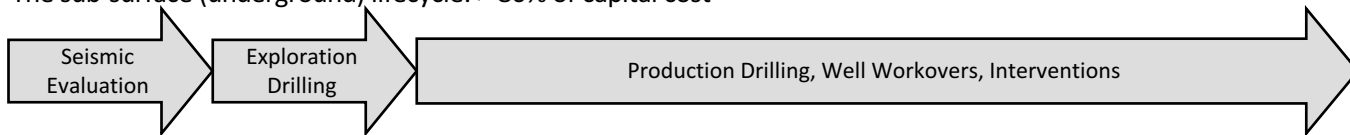


# The Oil & Gas Asset Lifecycle

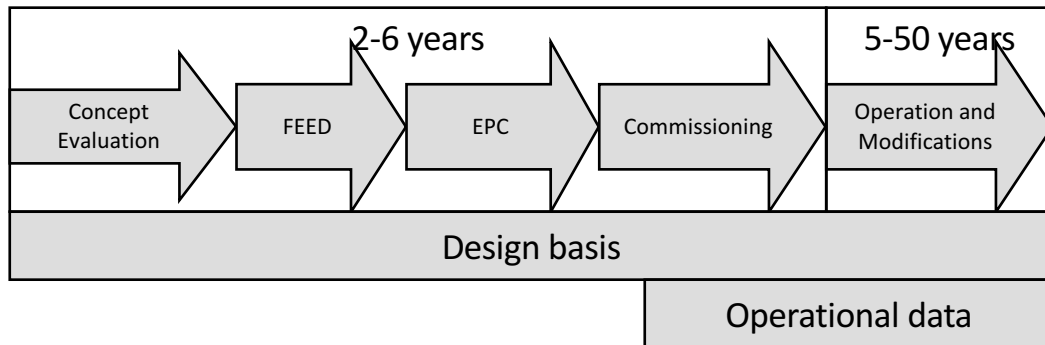
Alphabet soup:

- EPC: Engineering, Procurement and Construction
- FEED: Front-end Engineering and Design

The sub-surface (underground) lifecycle: > 80% of capital cost



The production facility lifecycle: < 20% of capital cost



## Processes governed by regulations, contracts and standards

- Regulations
  - Petroleum Law and Regulations
  - Tax Law
  - Competition Law
  - Stock Trading Law
  - Labour Law
  - Safety Regulations
  - Environmental Regulations
  - Maritime Law
- Contracts
  - Lease
  - Partnership
  - Infrastructure
  - Transport
  - Services
- Standards
  - NORSEK
    - <http://www.standard.no/en/Sectors/Petroleum/>
  - OLF / CDA Guidelines
  - ASME
  - API
    - American standards and practices
  - ISA
    - American instrumentation and industrial IT standards
  - ISO



# Optique can add value across the natural resources business (and any other business!)



# Making data access really scalable needs

- Work in specifying and maintaining **useful semantic models about real things**
- Good, fast, effective **databases** – in memory and in place
- Linkages to **natural language** – in data and interaction
- Efficient, predictable access to **data spread across the cloud**
- **Secure**, role-based access to data
- **High-performance computing** to access data, reason and calculate
- Modelling, optimization and reasoning – **analytics**
- Sensitive and effective transformation of **work practices**
- **i.e. the whole of *industrial informatics*.**



**SIRIUS**

Center for Scalable Data  
Access in the Oil and Gas Domain

[sirius-labs.no](http://sirius-labs.no)



WE ARE SIRIUS

